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MACHINERY AND TONNAGE. *See p.* 53.
SCREW PROPELLERS. *See p.* 55.

AUG 8 1917 Received AUG 6 1917 Received

SHIPBUILDING AND SHIPPING RECORD

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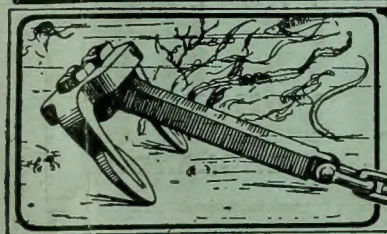

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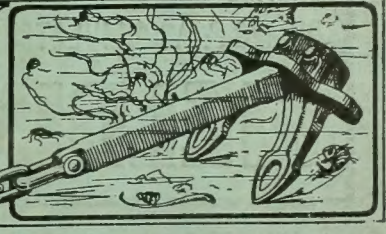

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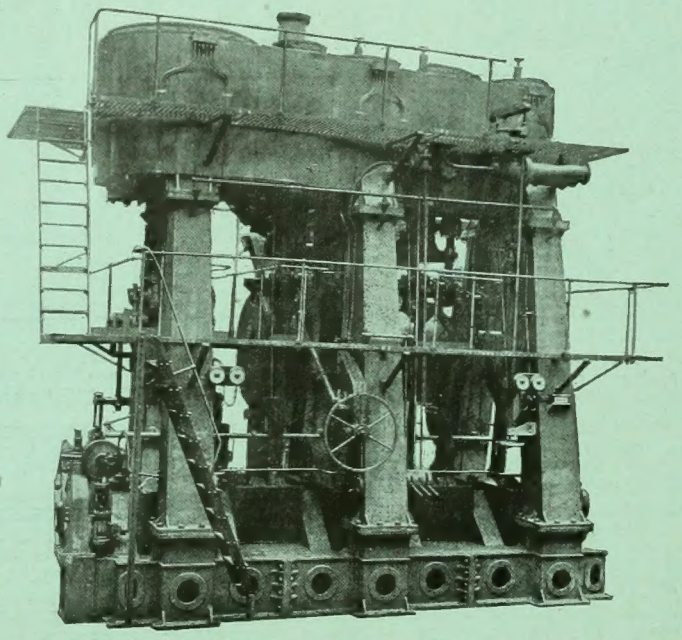

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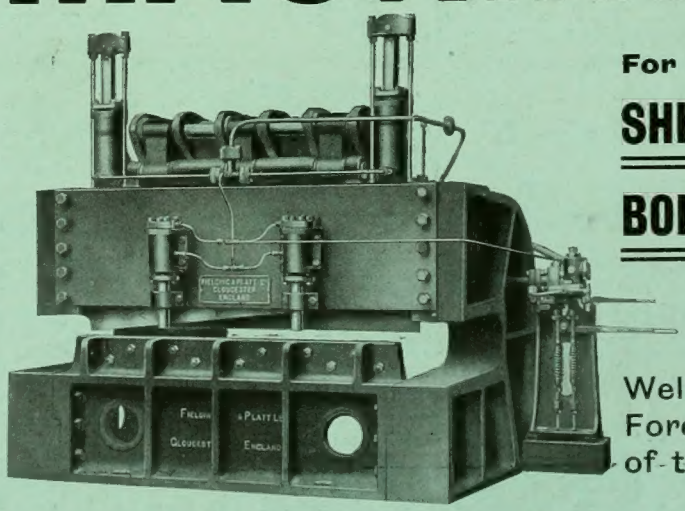

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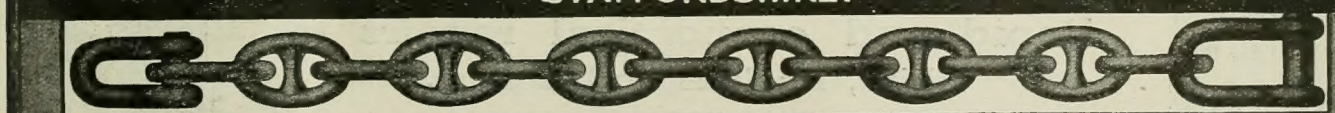

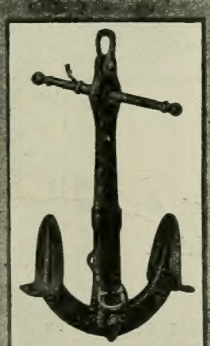

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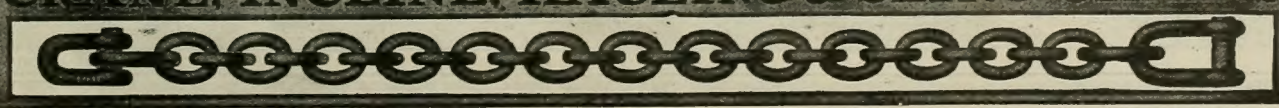

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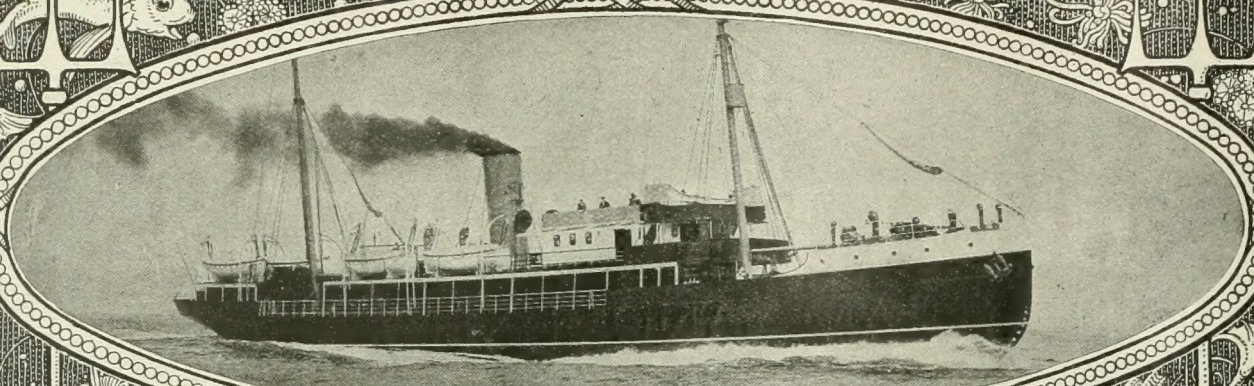

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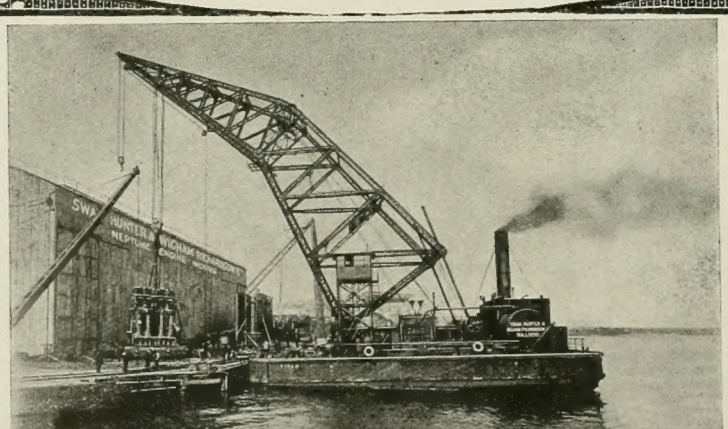

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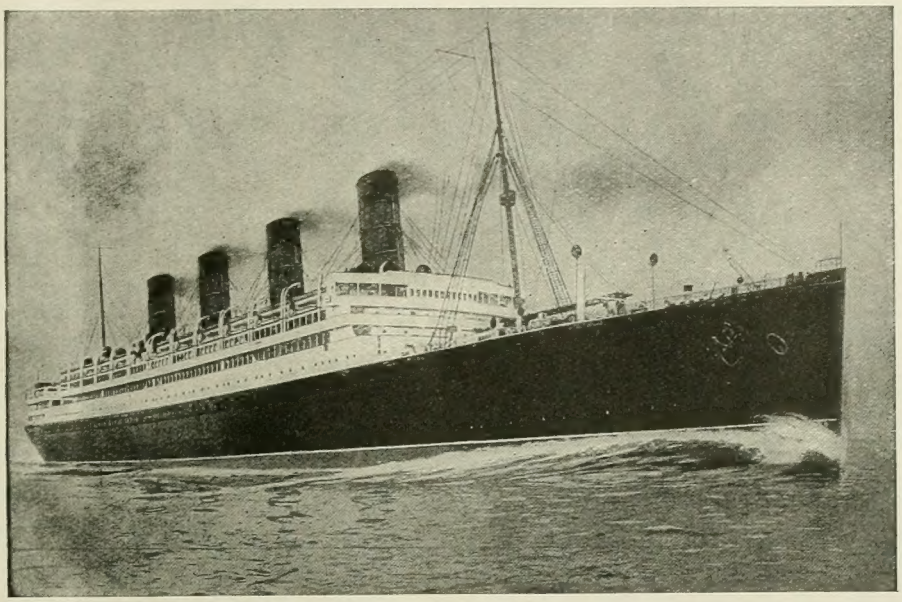

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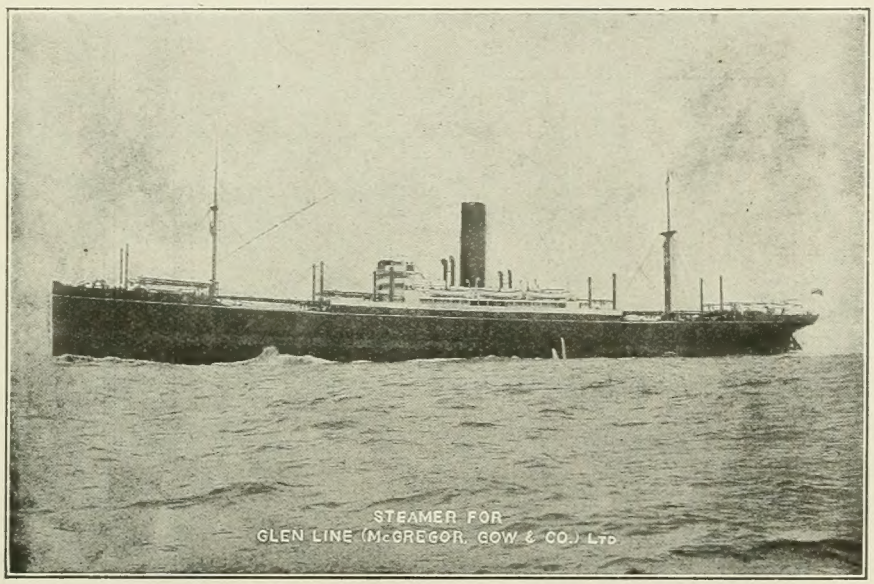

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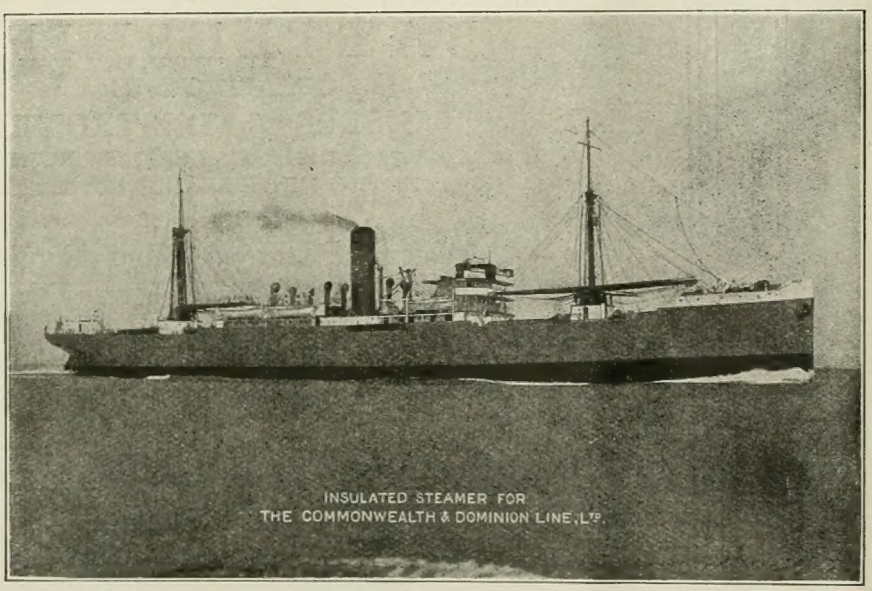

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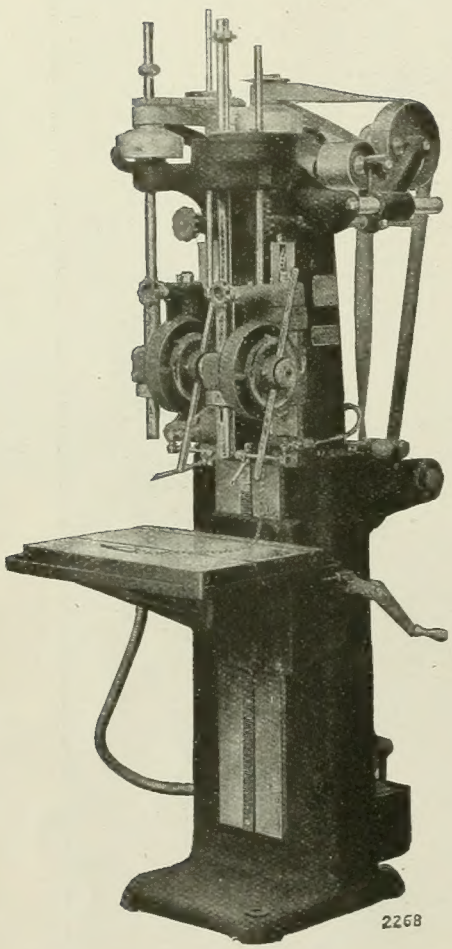

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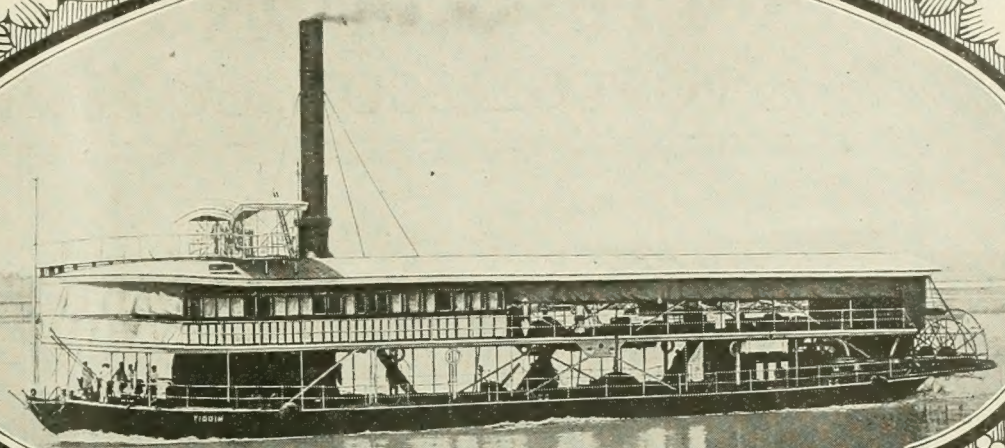

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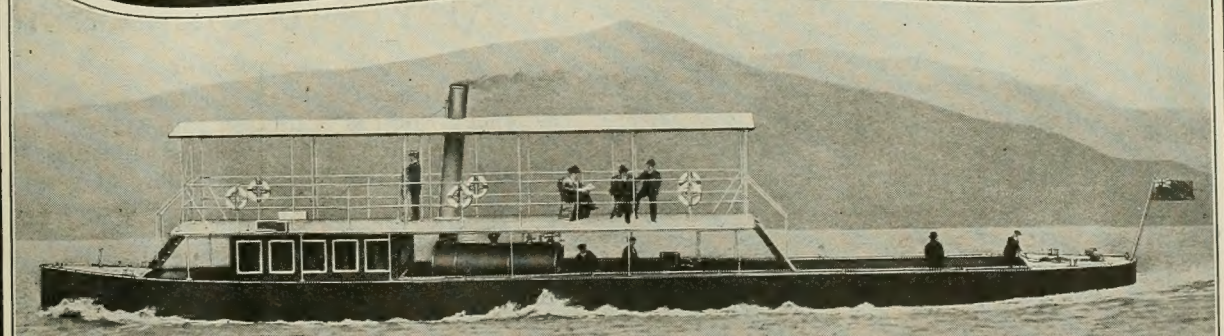

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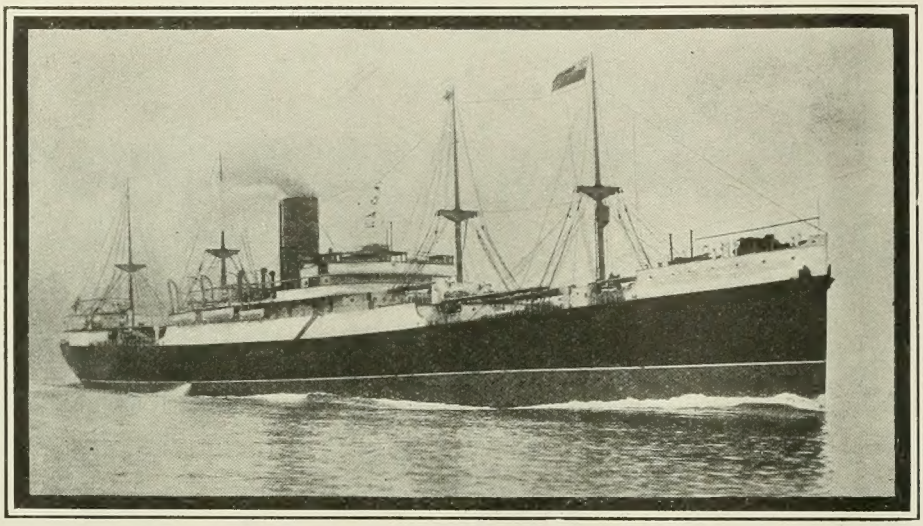

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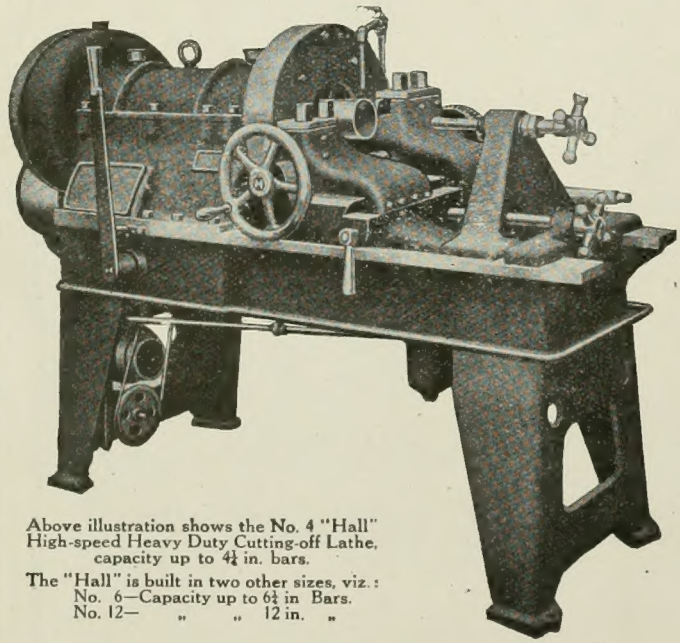

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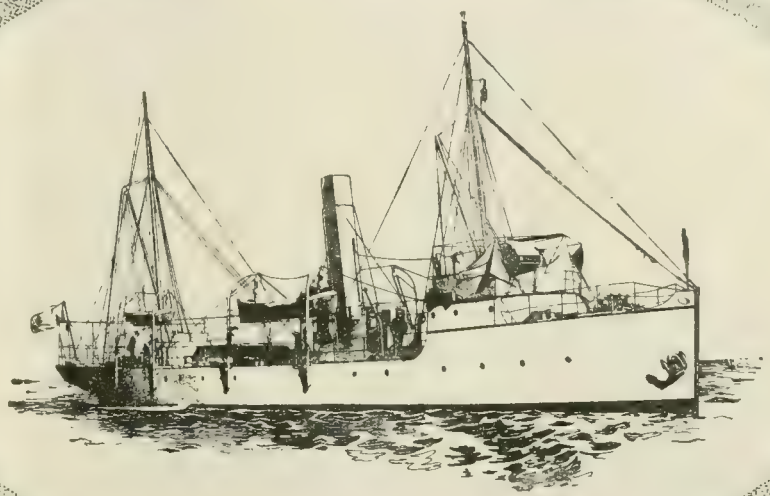

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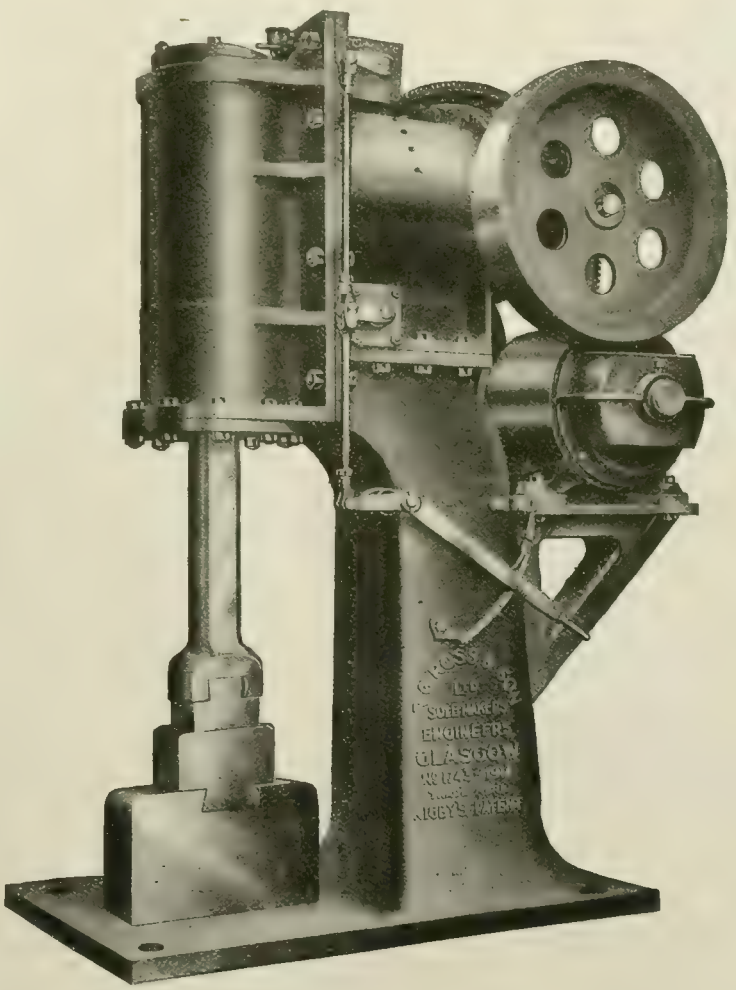

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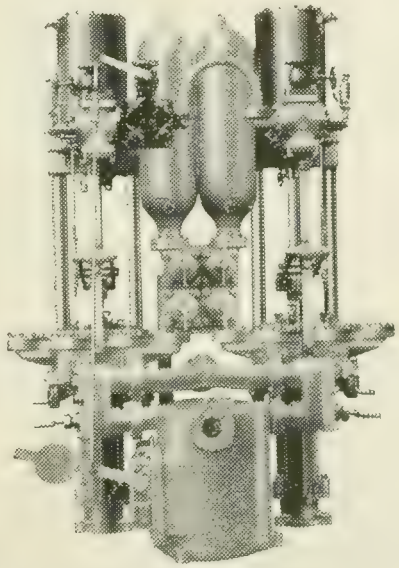

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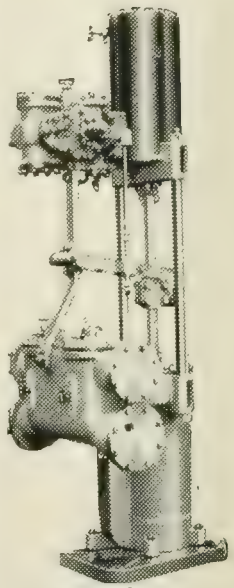

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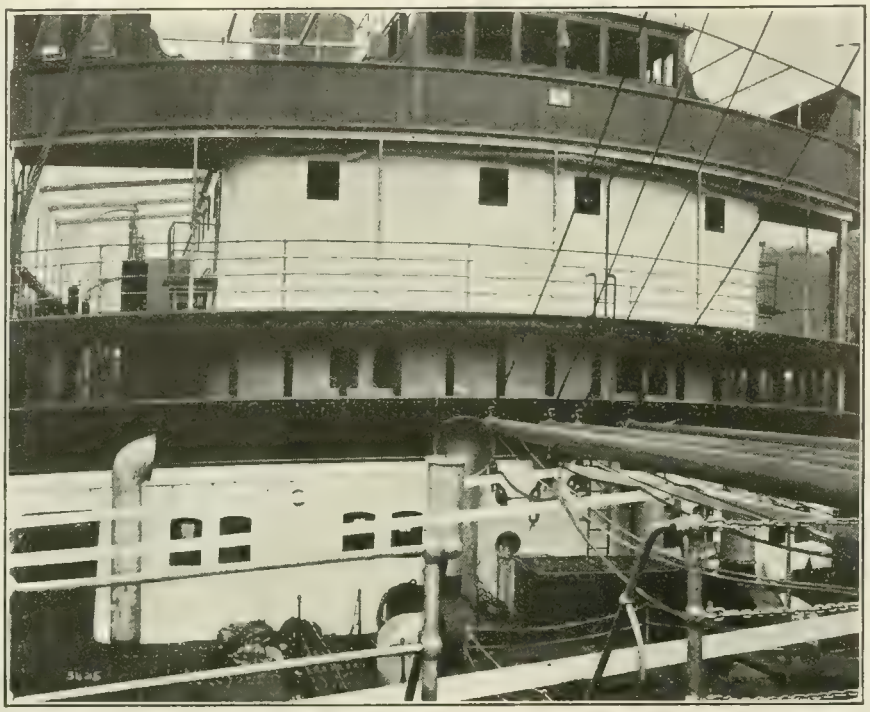

¶ These Windows are Frameless, the exact size being 39" high, 30" wide, ⅝" thick.

¶ In order to stop all vibration and to secure water-tightness, a hinged frame of bronze lined with fibre is suspended from the top and is actuated at the bottom by a small hand-wheel at the waist-line, a turn of which firmly secures the window.

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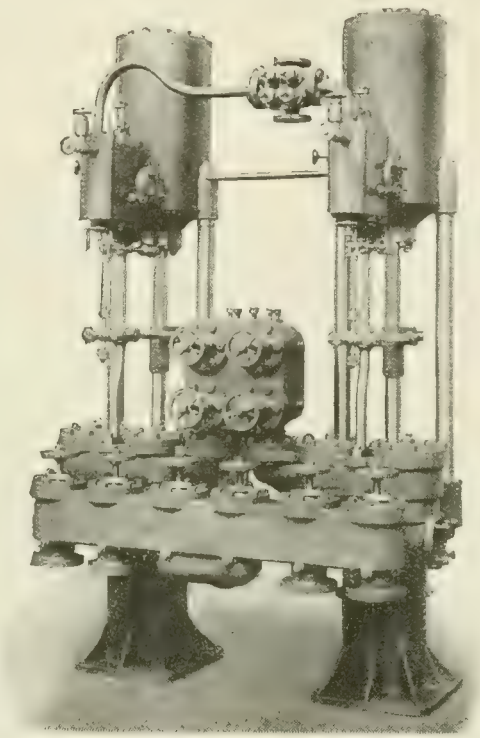

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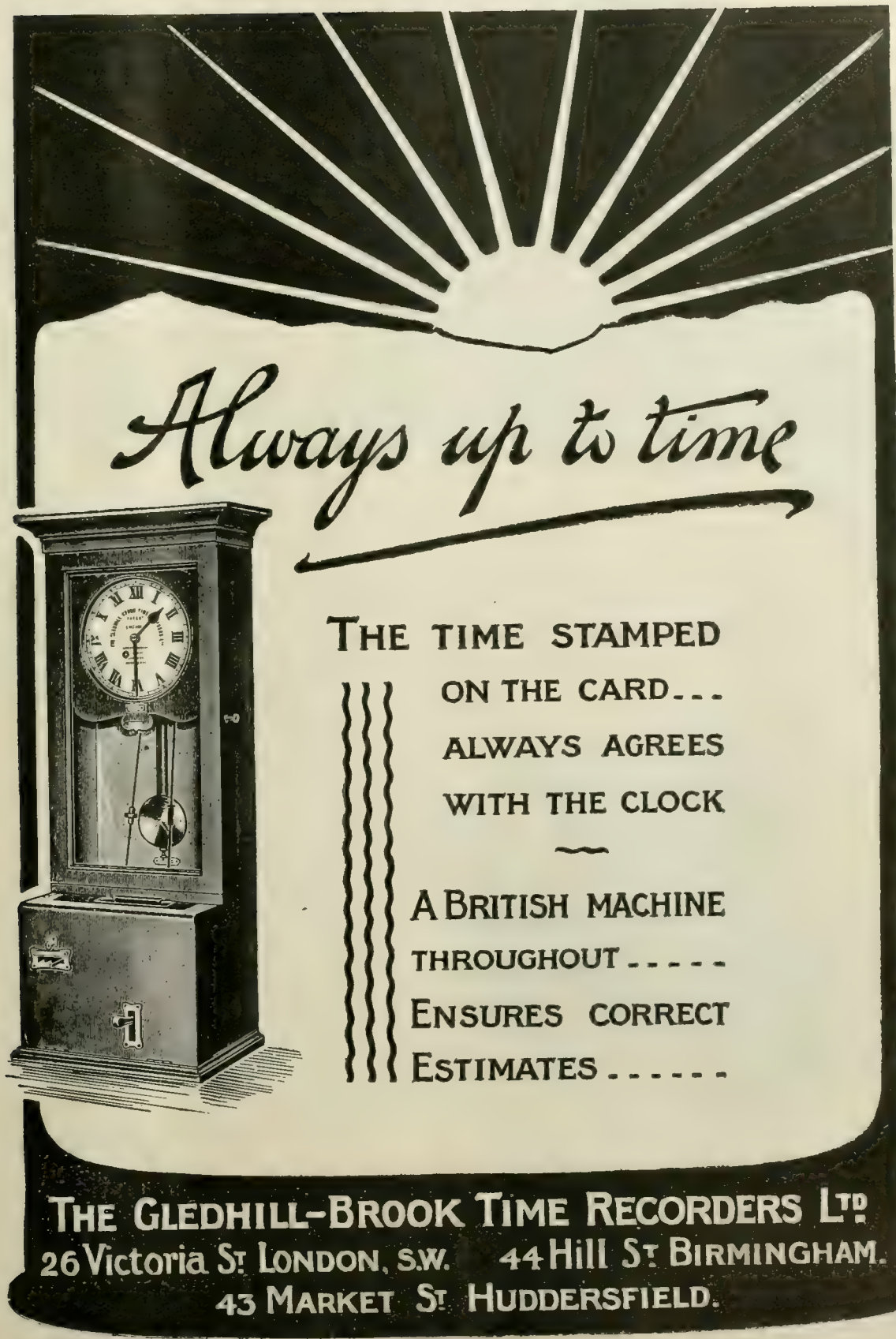
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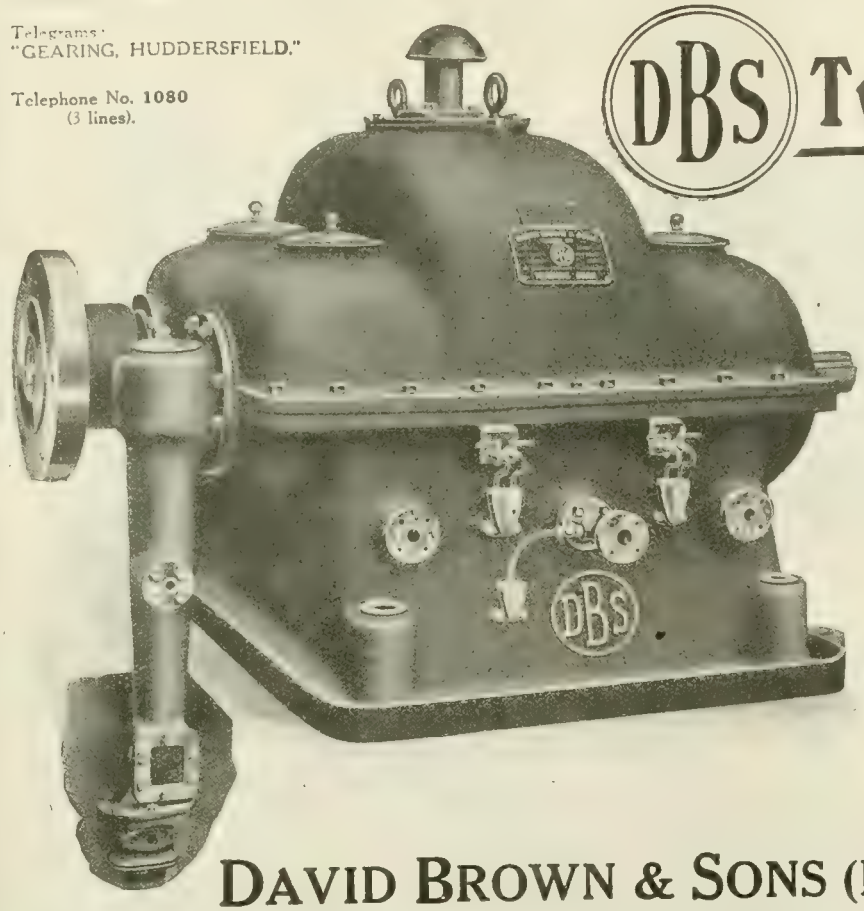

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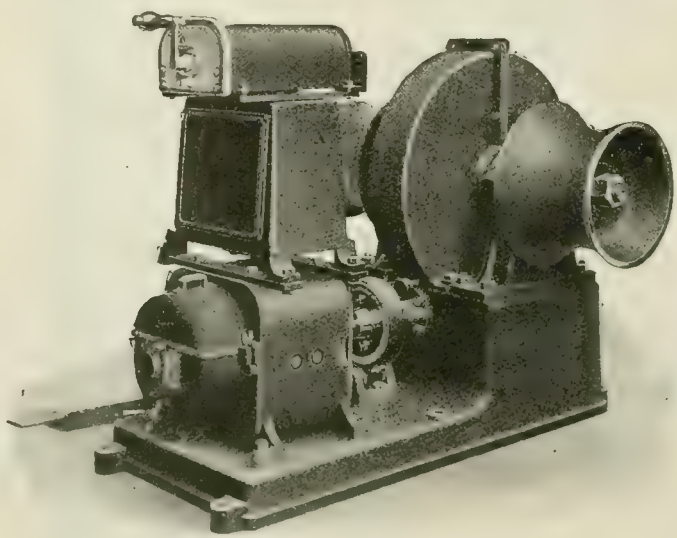

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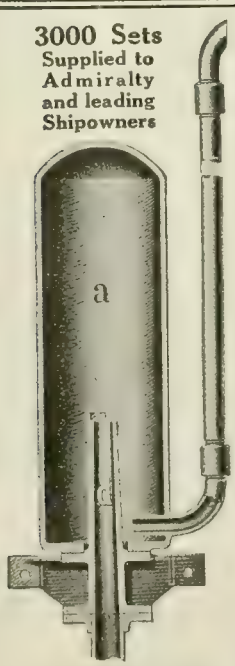

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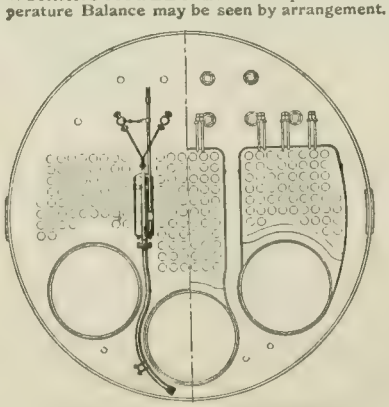

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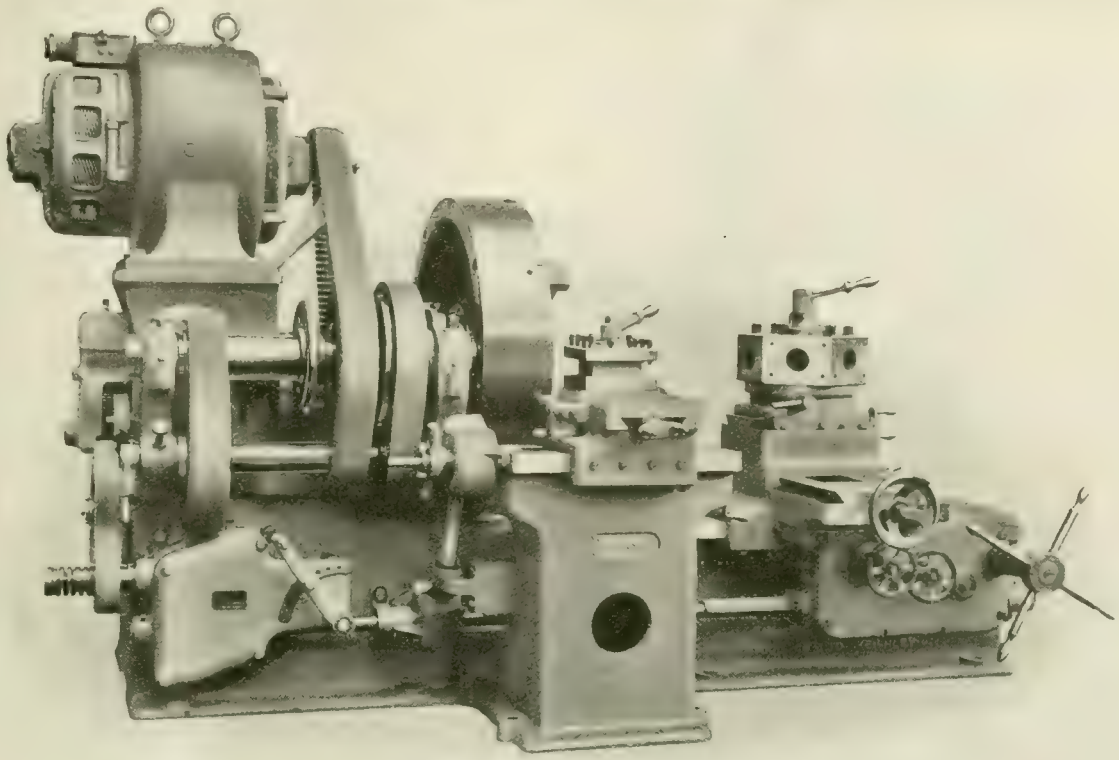

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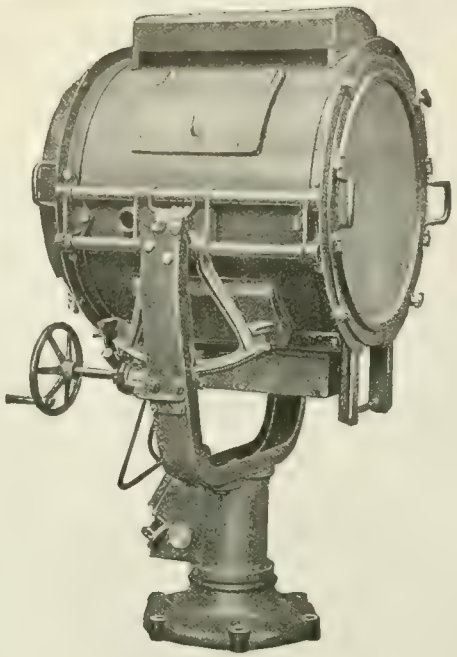

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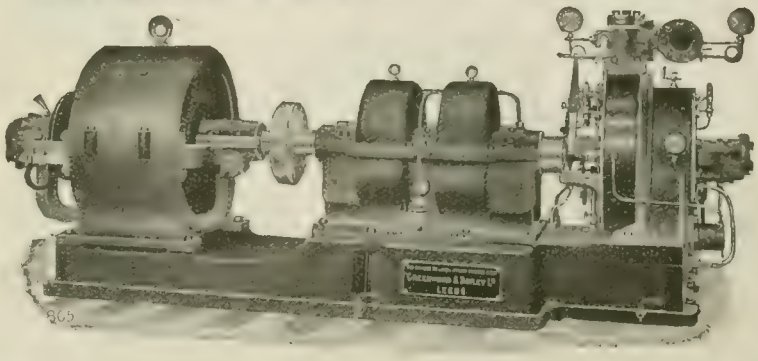

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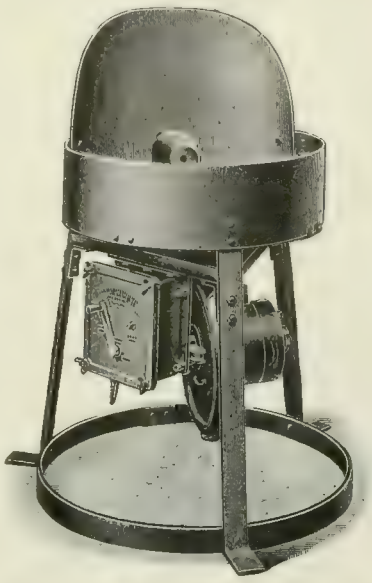

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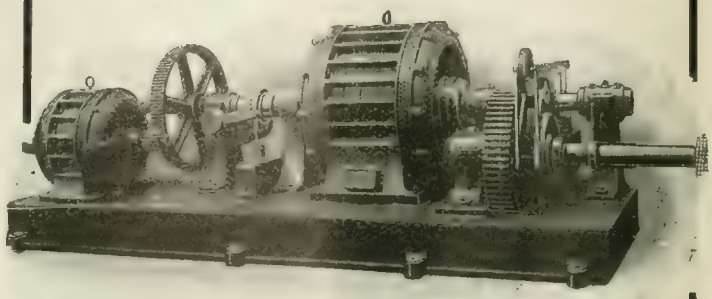

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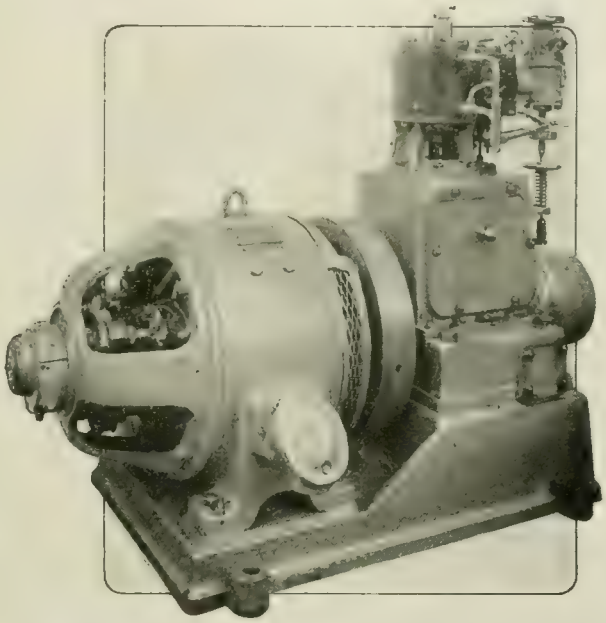

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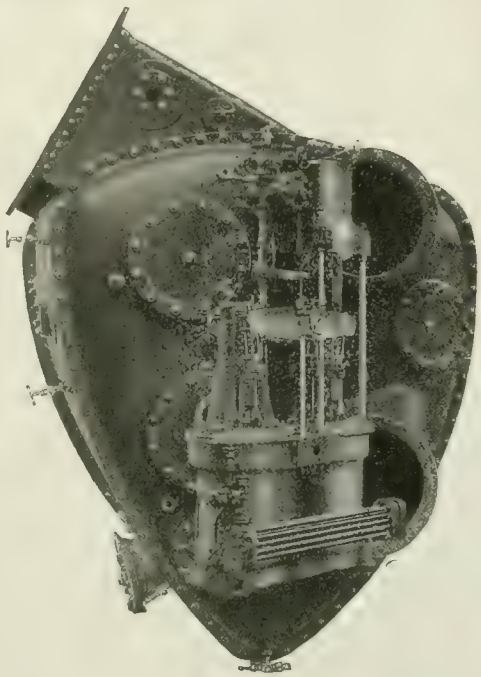

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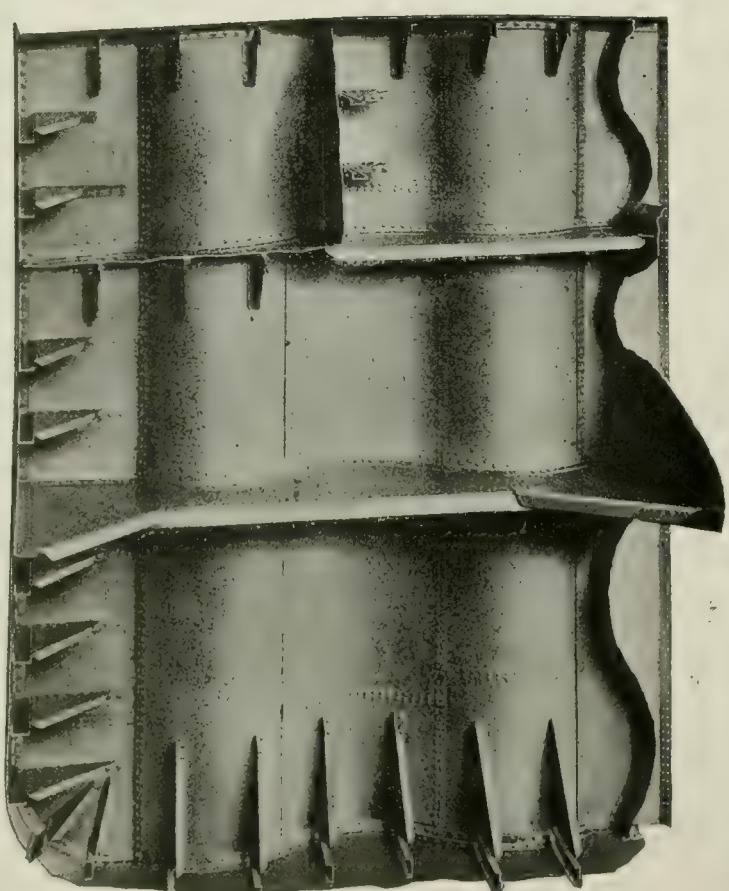

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VOL. X.] THURSDAY, JULY 19, 1917. [No. 3.

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SOMETIMES the margin between a war risk and an ordinary marine risk is very narrow. Recently a case arose in the courts where it was held that the collision of a vessel with the submerged wreck of a ship sunk by a hostile submarine did not constitute a war risk. Now a decision has been given that the collision of vessels navigating without full lights at night under proper Admiralty orders does come within that category. The principle that distinguishes the two cases is that the latter was a proximate consequence of hostilities and the former was not. The second case where the war risk has been held to arise concerned the collision of the *St. Oswald*, belonging to the British & Foreign Steamship Company, Ltd., and the French warship *Suffren*. The *St. Oswald* was running on requisition under the Admiralty Charter T. 99, by a clause of which the Government assumes the war risks, but not the ordinary marine perils. She was running one night in the Eastern Mediterranean and in pursuance of instructions from the Admiralty certain of her lights were obscured. The consequence was that accurate and timely observation in regard to the vessel was impossible, and in manœuvring to escape contact with the *Suffren*, the *St. Oswald* was rammed and sunk. Did the collision result as the proximate consequence of warlike acts? Mr. Justice Rowlatt in the Commercial Court came to the decision that it did so result. The true view in his opinion was that the steaming without lights was a warlike operation, that the vessels were in instant peril as the consequence of this warlike operation and that the manœuvres which they executed did not constitute an intervening cause of collision, but were to be regarded merely as acts [illegible] to escape from the existing peril. The owners of the *St. Oswald* are thus entitled to recover from the Admiralty under the liability of the latter for war risks. Any other decision would have been manifestly unjust. Yet it is rather novel to see a collision appearing as a war risk. On principle the decision in this case is very sound, because a warlike operation was the proximate cause.

Collision as a War Risk.

Assurances have been given to the British delegates at the Hague by the German representatives, that the British officers of the mercantile marine will be returned to officers' internment camps. We do not know whether this step has yet been carried out, but the arrangements for the necessary payments are in the hands of the Board of Trade. We hope no hitch will occur, but until the results of the Hague negotiations are known to have been ratified by the German Government as well as by our own, there is just the chance of some obstacle presenting itself. Probably it is not very great. If the position of these gallant mercantile officers has, in fact, been definitely and conclusively regularised, it will be most satisfactory. They have certainly had friends in all parts of the House of Commons, and in particular the painstaking efforts of Mr. Peto, M.P., on their behalf deserve to be singled out for mention. Of course we do not know the extent to which the assurances given at the Hague contribute towards a permanent solution of the status of merchant service officers who are taken prisoners in the war. The German Government, when Captain Blaikie was taken prisoner, came to the conclusion, no doubt under a vivid realisation that a repetition of the outrage on Captain Fryatt would lead to inconvenient reprisals, that they were to be regarded as combatants. But by treating them in this category, the Germans claimed that they were entitled to torpedo ships carrying combatants at sight. The British Government on the other hand maintains the very old established rule of international law, that a merchant ship is entitled to act on the defensive against hostile craft when she is attacked. It is an authorised act of self-defence, but the existence of this right does not bring officers or crew within the recognised categories of combatants.

Interned Merchant Officers.

The news that President Wilson has issued a decree prohibiting German insurance companies doing further business in the United States, and forbidding American companies and underwriters to effect re-insurances with enemy concerns, has a fuller significance than appears from the bare announcement. It will be remembered that considerable astonishment was expressed in insurance circles on this side when, on joining the Allies, America excepted insurance from the prohibitions which were enacted with regard to all other enemy businesses. Now, not only has further business been prohibited, but all existing contracts are suspended for the duration of the war, with the exception of those concerning vessels now at sea. It is probable that the limited market that still prevails in America was a cause of leniency being shown in the first case, and, alternative channels having now been opened, this temporary measure has been withdrawn. It is possible that the revelations of Germany's method of tabulating insurance information for national purposes, as revealed at the Rome Economic Conference, may have convinced America that the continuance of so highly organised a system of espionage was too unhealthy for her national welfare to be permitted to continue uncontrolled. Perhaps the best construction which can be put upon the announcement is that the American insurance world is brought into line with the rest of the Allies thereby, and American underwriters are placed in a position to give their support to their British and Allied *confrères*, and to participate in the benefits which will accrue from the joint action which is even now being accomplished.

Prohibiting German Insurances in America.

Shipping and the Finance Bill.

On Tuesday the House of Commons completed its final consideration of the Finance Bill. The unequal position of the shipping industry is still perpetuated in the measure, and although with the adjustments which were made in Committee the financial burden in hard cases may obtain relief, yet the principle of differentiating unfavourably between it and other industries remains. One last protest on behalf of the shipowners was made by Mr. Houston in the debate on the third reading, but of course in war time it is an impossible proceeding to carry opposition to a Finance Bill to the same extremes as would be legitimate in peace time. We think that the time will come when Mr. Bonar Law will regret some of his utterances in regard to shipping. No one doubts his assurances that he personally entertains no vindictiveness to shipowners. That is not the point. What is in question has been the policy of the Government of which he has been the spokesman. They have taken no adequate steps to counteract the mischievous impression that shipowners have been profiteering in regard to food. Our readers know the baselessness of this prejudice. All that the shipping community desires is to be treated on the same basis of taxation as other industries. They have garnered wealth for the nation on all the trade routes of the world, and the nation and the Exchequer have been under obligations for their enterprise and business ability. We have made our comments on their treatment in connection with the Finance Bill, and when the war is over, British commerce will have to rely upon them as one of the essential agents in the reconstruction of our trade fabric.

Shipowners and the State.

Between politicians who are in daily need of something or somebody to talk about, and the public who have "profiteering" on the brain, the British shipowner is having a distinctly uneasy time of it. It is undeniable, of course, that the community has some reason to complain of the high cost of living, and that the politicians are attending to their legitimate business in making most of the grievances. There does not seem to be much doubt, however, that if the shipowners as an organised body took the trouble publicly and fully to state their case a great deal of what may be called the "ginger" would disappear from the agitation. In a previous issue we expressed the opinion that something of the kind might be done. We are not disappointed that it has not been done, for we feel that it is of considerable less moment to shipowners to get the opinion of the public right than it is to get the Government to go below the surface of things to the deeper essential facts of the matter. British shipping is a vast complex business on which, as we have seen, not merely the prosperity, but the actual security of the Empire depends. The war has seriously dislocated it, and under the delusion that shipowners are "exploiting" the community's needs, the State seems to be disposed to hinder rather than to facilitate its restoration to full efficiency. There is no need to go into the details ; that is broadly the position, and shipowners are wise, we think, in preferring to discuss it with the Government rather than in authorised statements to the general public. Ministers are not, it is true, as sympathetic as they might be, but that does not alter the fact that for good or ill the future of British shipping is in their hands.

War or Marine Loss Arbitration.

The proposal for arbitration on the question of whether the loss of a missing vessel should be settled on a marine or war policy, to which we referred in our issue of May 24, has now been the subject of another representative meeting, and considerable progress has been made in the formation of the scheme. The matter is one that requires expedition, for there are several cases which will come within the scope of the new arrangement at present in abeyance. Owners will be wise if they refrain from pressing for the settlement of these losses if the necessity of taking the matter into court presents itself. With the arrival of the new scheme several disabilities which attach to legal proceedings will be done away with. Apart from the time wasted and the expense incurred when legal aid is invoked in these matters, the arbitration scheme has several distinct advantages over proceedings in court. For instance, a legal proposition must be brought to a definite conclusion and nothing in the nature of an open verdict can be come to, while under arbitration the probabilities of a case may be weighed and an opinion expressed as to the probability of a loss being caused by a war or marine risk. This method may be carried yet further, and an arbitrator suggesting that the probability of a vessel being lost by war equals five-sevenths, while the probability of a marine loss equals two-sevenths, might lead to an adjustment of a loss on this basis, the war underwriters paying five-sevenths of the amount at risk and the marine underwriters the balance. This would probably prove more acceptable to the insurers than the 50 per cent. basis which is now occasionally resorted to. A further benefit which may accrue under the arbitration scheme is that the Admiralty may be found willing to disclose evidence of a secret nature which they would hesitate to divulge in open court, though we believe that the department concerned has refused to bind themselves in this matter. The point that should not be overlooked is the possibility of fresh evidence being brought to light concerning these difficult cases after settlement.

The Standard Ships.

The announcement that the first standard ship of the Government programme will come into service about the end of this month, was made in the House, the other day, by Sir Leo Chiozza Money. There is a feeling abroad that the work on these ships has not proceeded as satisfactory as might have been the case. Doubtless some difficulty would be experienced in organising the construction of a large number of vessels of uniform design ; the distribution of plans, the procuring of material, the adherence to uniformity in practice would all require time and attention. It is probable that when once this has been thoroughly organised, if this is not the case already, acceleration will result. One point, however, has frequently appealed to the writer, that is, that shipowners, and also the Government, do not seem to realise the enormous delay which occurs in the building of ships through not having the whole design thoroughly thrashed out and decided upon before the construction of vessels is proceeded with. Alterations are the abhorrence of shipyards, but it seems to be impossible to have a ship built without these taking place. In one particular case when the requirements for a particular trade had been stated a design was prepared "A." Before the ship was built the 26 letters of the alphabet had been used and double letters were employed to designate designs submitted, discussed, and set aside. Time, money and interest in the work is lost by delays caused in this fashion and it seems that much of this could be saved by careful consideration.

Sir J. Biles and the Mesopotamian Commission.

We observe that Mr. Chamberlain, the late Secretary of State for India, supports the attitude of Sir John Biles in protesting against the omission of the Mesopotamia Commission to call him as a witness. It appears that the Commission took the view that the responsibility for the execution of the river craft for the Tigris fell upon the India Office and they did not think it necessary to examine Sir John Biles, and one of the Commissioners has stated that they in no way called in question his professional conduct and ability. Mr. Chamberlain, whose loyalty to men who have rendered good service under him is a most pleasing trait in his character, insisted vigorously that Sir John ought, in the circumstances, to have been heard by the Commission. The late Secretary of State for India was not prepared to go into technical questions in the House of Commons, but he understood that Sir John Biles was prepared to defend the advice

which he gave in regard to the river steamers. These, Mr. Chamberlain pointed out, are the steamers now on the river which are giving satisfactory results. Sixteen more have been built to Sir John Biles' design for the War Office since it took over the conduct of the campaign. Six of them are already on the river and are doing excellent work. That is the testimony of Mr. Chamberlain in the House of Commons. They have been highly spoken of by General Collard of the Transport Section of the Quartermaster-General's Office on his return from Mesopotamia. Sir Arthur Lawley has made a statement to the same effect. In these circumstances it is a great pity that the Commission did not take the evidence of Sir John Biles.

Unprogressive Trade Unionism.

The people who are most affected do not, of course, quite realise it; but it is nevertheless the case that there is nothing progressive in the current activities of Trade Unionism. There are certainly "demands," strikes, and threats of strikes which suggest that the rank and file are bent on making hay while the sun shines—are, in other words, making as much as they can out of the nation's necessities; but that can hardly be called progress, seeing that in their more or less irregular proceedings they are acting not with the full concurrence of the constituted authority of their societies but, as a rule, in spite of it Before they can justifiably do many of the things they are doing, or realise their aspirations in respect of post-war conditions, practically a new Trade Union structure will have to be set up. Executive Councils are not, however, wholly blameless for the pass to which things are coming. They may be, as some of them contend they are, powerless to do more than administer "the rules." But even administrators are expected to have a little foresight, and that is just the quality which the average Executive Councilman most conspicuously lacks. In most of the Labour negotiations of the war period the executives of many of the more important unions have contented themselves with saying "No." They have not looked the facts in the face and endeavoured to assist the Government to find ways out of difficulties. They are, too, maintaining the same negative attitude towards both employers and the State in respect of post-war conditions, and are apparently not in the least degree anxious collectively to assist in the reconstruction of industry. For these reasons we think it is beyond question that there is nothing progressive in the current activities of Trade Unionism.

Germany's Need of Ships.

Apparently the Germans are beginning to realise that they are themselves to be the principal ultimate sufferers from their unrestricted submarine "warfare." Some time ago we suggested that they would be; now there does not seem to be any doubt about it. It has at last become clear to our enemies that when the war comes to an end, every country which possesses a mercantile marine will be able to find plenty of national employment for its ships without thinking of German needs. That the fear is of a shortage of ships, rather than of a lack of owners' money for ships, is proved by the fact that all the current German talk is of State-aid to shipbuilding. At one time the tale is that the Imperial Government is of a mind to subsidise shipbuilders—why there should be any need to do so is a little obscure—and at another it is the shipowner who is to get the money. We may be sure that if the German Government decides to give money it will not give it to both builders and owners. The probability is that it intends not to give, but to lend money. Then there is Professor Flamm's idea that the State should take over shipyards, build standard ships, and run the vessels as a profitable commercial enterprise after the war. The true German touch is there, for the expectation not unreasonably is that freights will rule high in, at any rate, the early post-war period. For all we care, Germans may, of course, do as they choose in the matter. We are bound to say, however, that the knowledge that the submarine piracies are to hit them harder than anybody else does not exactly depress us. The wholesale sinking of merchant ships is the most shameful thing in the history of seafaring, and it is not unfitting that the pirates themselves should be the chief sufferers through it.

Cargo Ship Design.

Development in the structural design of cargo ships has been regular and well defined. A misconception of the true principles of design has been the legacy of the methods of construction employed in wood shipbuilding. In the old days the idea prevailed that in large vessels numerous tiers of beams were necessary, and if these were reduced in number some compensation required to be provided. A decided change from these conceptions is now evident. Large single-deck steamers have been built and have been great structural successes, of a depth which, in former years, would have demanded probably three tiers of beams. Mr. Foster King has pointed out that the tendency of all types of development, with the exception of the large mail and passenger steamer, has been towards reduction in number of parts, economy of labour rather than of weight, and an approximation to the principles of the design of an open boat. The many types of special construction which have been produced have been towards the providing of large capacity and large deadweight on limited draught, with ample water ballast capacity, unbroken stowage, and absence of hand trimming for bulk cargoes. In the diagrams of present-day cargo ships illustrated in our issue of January 3, the broad tendencies of design above enumerated are in evidence. Some measure of the efficiency of the structure is given by the deadweight-displacement ratio, and with certain types of construction this has reached as high as 75 per cent. Along orthodox lines also development has taken place and the registration societies are very much alive to the advantages accruing from better disposition of material. The demand for ships of still greater potentialities for economy will be most persistent after the war, and the shipbuilders of this country would do well to study carefully the problems of design and construction so that the maximum efficiency may be obtained.

Screw Propellers.

The design of the propeller is surely one of the most important problems which the shipbuilder is called upon to face, and it is the one which can be solved with the least degree of exactitude. There are so many variables in the problem, such as shape of hull, arrangement of shafts, speed of vessel, depth of propellers, all of which have a direct bearing upon the exact form of the propeller, so that whilst allowances can be made for the effect of one or more of these variables, our present knowledge is such that it is extremely difficult to make allowances for them all at one and the same time. In order to design the propeller for a new type of ship, two methods are available—we can by actual experiments in the tank determine approximately what shape of propeller is best suited for the given form of hull driven at a particular speed, or we can proceed by deduction from the tabulated results of more or less similar vessels designed in the past, using the comparative data or the empirical formulæ and curves obtained therefrom. Both these methods are open to objection, the first on the score of expense, and the second because as the type of vessel, arrangement of propellers, speed, &c., change, collected results recede farther and farther away from the actual case under consideration; moreover, fresh data is always being accumulated tending to render obsolete curves and formulæ previously used. In view of this accumulation of data, we call the attention of our readers to the first of a series of articles on the screw propeller (see p. 55) by one who has had a large amount of experience in the design of propellers, and who thus brings a wealth of experience to the solution of the many problems which arise.

In these articles will be found a concise record of all the recently accumulated data, together with methods whereby these may be utilised in the design of the propeller for any particular case.

ACCOMMODATION FOR SEAMEN.

WE have not so far been able to learn much regarding the details of the standard ships which are in course of construction for the Government, but the veil has been lifted on at least one important particular, and that is the accommodation that is to be provided for the crews on these vessels. In a letter to *The Times* recently Mr. Chas. P. Hopkins, Chairman of the Accommodation Sub-Committee of the National Sailors' and Firemen's Union, gives the story of the negotiations which have been carried on between the Ministry of Shipping and the Accommodation Sub-Committee.

It appears that on Wednesday, February 14, a deputation composed of members of the Accommodation Sub-Committee of the National Sailors' and Firemen's Union was received by Sir Joseph Maclay and his expert advisers on ship construction. It was intimated to the deputation that its suggestions and desires on this matter of accommodation would receive the sympathetic consideration of the Controller and his advisers. It was made known later that the Ministry of Shipping desired a further interview with the members of the deputation, and on April 23 there was another meeting. On this occasion the members of the deputation were shown plans in which many of their suggestions had been embodied, and opportunity was given for further suggestions. On June 1 a communication was received from the Ministry of Shipping enclosing a print giving the approved arrangements which showed that all and more than the Accommodation Sub-Committee had recommended had been conceded by the Ministry of Shipping and its advisers. The Sub-Committee had recommended that berthing accommodation should be aft instead of forward, that ventilation should be efficient and not merely mean the provision of a ventilator situated in an unsuitable position, that the lighting should be adequate, that no bunks should be placed in such a position as to obstruct the light, and that a separate room should be provided for the crew to take their meals in.

According to the arrangement approved by the Ministry of Shipping, the accommodation for the crew is aft, there is a separate room for meals, and what will be greatly appreciated, two bunked cabins or cubicles instead of forecastles to sleep in. Each cabin is provided with a locker and a seat in addition to the two bunks, whilst admission to the water-closets is obtained from outside under the break of the poop, and admission to the bath and wash-places is obtained from the alley-ways under cover, all of which goes to perfect the improved arrangements. The ventilation and lighting are described as excellent, and it is felt by the Accommodation Sub-Committee that a real turning point in the history of accommodation for crews on merchant ships has been reached in what is being done by the Ministry of Shipping in the standard ships. As far as we are able to judge from the details thus published the arrangement of the crew's quarters is in close agreement with the suggestions laid down in the Henry Saxon Snell prize essay on "Suggestions for Improvements in the Sanitary Arrangements and Appliances on Shipboard," by Dr. William Hanna, M.A., the Assistant Medical Officer of Health at the Port of Liverpool, an abstract of which appeared in the *Shipbuilding and Shipping Record*, March 22 and 29, 1917. It is not an innovation to place the crew's quarters aft, this having already been done on many vessels, but the practice is far from general.

The provision of two-bunked cabins, although advocated in the paper referred to, is, we believe, an innovation, and it should be greatly appreciated by the men, whilst the separate mess room should make for far more sanitary conditions both for sleeping and for meal times. Details are lacking as to the ventilation, but in view of the larger space entailed by the separate cabins and mess rooms, it is certain that greater air space is provided, and if, as can be assumed, efficient means have been taken to ensure a gradual circulation of air through the poop there can be no doubt that, from the point of view of comfort, the standard ships will be greatly appreciated by the crews that man them. And in any case the Ministry of Shipping is to be congratulated on having thus shown that the State is solicitous for the comfort and health of the brave men that serve it in its hour of peril.

WELDING SHIPS.

THE recent statement made with regard to the damage done by German crews on ships interned in America calls attention to the possibilities and probabilities of oxy-acetylene in ship work. For some time past now oxy-acetylene cutters have been common, both in new construction and repair work. In the latter it has a peculiar value, being very portable and capable of cutting away the most distorted parts with ease. It appears that the German crews made extensive use of oxy-acetylene cutters to partially cut through the joints and seams of the steel structure of their vessels. This had been surreptitiously but skilfully done, and the sections cut had been carefully painted over so that all traces of the work were obliterated. The purpose of this is quite obvious—the damage would not in the ordinary way show itself with the vessel in harbour, but when the severer strains were brought on her at sea the whole structure would probably collapse.

This kind of work is practically identical with the system adopted by the Germans in the districts evacuated as a result of the Anglo-French pushes. In these cases the method has been confined to houses. The flooring supports and the main posts in any houses that happened to be habitable to any extent were sawn practically through and the cuts covered over with putty and paint, or paper, or some other means. It was the hope of the Germans that when a sufficient number of men were quartered in these houses the floors and sides would collapse and many men be killed and injured—another example of frightfulness.

The details of the damage to ships have been given by Mr. C. W. Brett, managing director of Barimar, Ltd., welding and general motor engineers, and he says that fortunately the damage was discovered, and it is gratifying to know that the scientific welder can thoroughly repair every part injured. It is very encouraging to know this, although it sounds somewhat optimistic. Nevertheless, there are many who think that there are possibilities of welding a ship together in the future. Up to the present, welding has been limited to the joining of landing edges of leaky seams of plating and cracks in castings. These matters, however, are really small details. Rivets form practically the one and only means of connecting plates and angles together. Riveted joints are never as efficient as the parts of the structure they connect together, and the labour troubles in connection with them loom very large. The use of rivets leads to the addition of a multitude of small weights due to laps, butt straps, angle bars, doublings, corner pieces and so on, and creates a non-uniformity of strength and elasticity throughout the whole of the ship. In addition, since a riveted joint is less efficient than the parts of the structure it connects, the whole of the structure must be made much stronger than is necessary. If there was no weakening at the joint the structure of a ship could be made much lighter.

Three years ago a paper was read by Mr. T. G. John at the summer meetings of the Institution of Naval Architects on "Shipbuilding Practice of the Present and Future." He stated that there was a great need for the adoption of reliable fusion process for connecting structural material, qualifying that statement by saying that it was necessary, if only to reinforce the efficiency of the riveted joint. Needless to say, there is no immediate prospect of the abolition of the rivet itself in general constructional work, but it is by no means certain that it could not be adopted in parts

of the ship where it is unnecessary to maintain any great strength, such as light decks and bulkheads. If any experiments have been carried out recently their results have not been published, but experiments carried out previous to the war were not very encouraging. There would, however, appear to be sufficient justification for the prosecution of research work on this subject, even if it were only successful in dispensing with rivets in certain special parts of a ship's structure.

MACHINERY AND TONNAGE.

IT is very questionable if the present laws regulating the measurement of ships for tonnage give anything like a fair basis between different types of ships. This is particularly the case with regard to the tonnage deduction allowed for the space occupied by propelling machinery. In arriving at the net tonnage under the present laws the rule is that if the space occupied by the propelling machinery is between 13 and 20 per cent. of the gross tonnage space, the deduction to be made from the gross tonnage on this account in arriving at the net tonnage is 32 per cent. of the gross. There is no discrimination, therefore, between the vessel fitted with machinery of low power and occupying, say, just over 13 per cent. of the gross tonnage space and the ship fitted with moderately high-powered machinery, the space for which occupies, say, nearly 20 per cent. of the gross tonnage space. Apart from this, should the propelling space be 13 per cent. or less of the gross, the deduction from gross in arriving at the net on account of propelling space is only $1\frac{3}{4}$ times the actual propelling space. In consequence, the ship whose propelling space is just over 13 per cent. of the gross tonnage has a further 9 per cent. off the gross tonnage in arriving at the net as compared with a ship having a propelling space 13 per cent. of the gross.

The same is true with a vessel whose propelling space is 20 per cent. or more of the gross tonnage. Here, again, the deduction allowable is $1\frac{3}{4}$ times the actual propelling space, so that a vessel with the propelling space just under 20 per cent. of the gross has 3 per cent. of the gross tonnage added to the net, as compared with a vessel with 20 per cent. propelling space. There is a limit fixed to this deduction for propelling space, as it was found in high-powered vessels—especially in tugs—that the propelling space would be quite a large percentage of the gross, and when it was increased to $1\frac{3}{4}$ times its actual amount the result was that a vessel might even have negative net tonnage. It is quite reasonable for a tug to have a small amount of net tonnage; otherwise they would be very heavily handicapped in tonnage dues. On the other hand, it was not thought fair for larger ships to be able to obtain such a small net tonnage. In consequence, a limit was put upon the deduction for propelling space. The rule now stands that no deduction for propelling space must exceed 55 per cent. of the gross tonnage after all other deductions have been made for crew spaces, &c., except in tugs exclusively used for towing.

Some interesting cases have arisen where the propelling space has been very nearly but not quite 20 per cent. of the gross tonnage. In such cases, expedients are often adopted to ensure that the space will be 20 per cent. or just over. In one case the ship as built had a propelling space 20·01 per cent. of the gross, and consequently obtained 35 per cent. deduction from the gross tonnage in arriving at the net. After she had been in service for some time a wireless telegraphy house was added, which, under the tonnage laws, has to be measured in the gross. The result was that the propelling space came out to be 19·99 per cent. of the new gross, and if this had been allowed to remain the deduction for propelling space would have been only 32 per cent. of the gross. To obviate this, the light and air spaces over the boiler room were raised and the owners claimed for these spaces to be measured in the gross tonnage. The result was a certain further addition to the gross tonnage but a greater percentage addition to the propelling space, so much so that the percentage of the latter again became 20·01 per cent. of the gross, very little being added to the net tonnage in consequence.

Needless to say, it is not uncommon when a new vessel is under consideration to find special efforts being made to make the propelling space come out at over 13 per cent. of the gross tonnage, or over 20 per cent., as the case may be, according to the power of the ship. In most cases where vessels are fitted with steam reciprocating engines the propelling space will never be appreciably less than 13 per cent. of the gross. Should it be slightly under it is not a difficult matter to increase it so as to bring it just over 13 per cent. This rule for the tonnage deduction on account of propelling space was brought into force about 30 or 40 years ago, and at that time the 13 per cent. was fixed to encourage owners to provide ample space for their machinery in order that the engine-room staff should be more comfortably housed than they had been in the past. At the same time provision was made that the space occupied by the propelling machinery should not be unreasonably large, and instructions are given by the Board of Trade to their surveyors with regard to this.

It has already been said that the rule for the deduction on account of propelling space was made some years ago. Since then machinery has altered very considerably. The 13 to 20 per cent. still continues to be fair where steam reciprocating engines and cylindrical boilers are fitted in a vessel. At the present time, however, many improvements have been made both in engines and boilers. The ordinary turbine occupies somewhat less space than the reciprocating engine of the same power and the geared turbine occupies appreciably less space. With the advent of the double reduction geared turbine the space required has been very substantially reduced. In consequence, in even moderately-powered vessels fitted with geared turbines, it is practically impossible to make the propelling space amount to 13 per cent. of the gross tonnage. Going still further, if water-tube boilers are fitted in place of cylindrical boilers, the propelling space is still further reduced, and if the water-tube boilers should be fired by oil fuel there is a still further reduction. Apart from this, the oil engine is now being seriously considered and actually being fitted in many vessels, and no doubt after the war it will find even greater vogue. Here, again, the space occupied for the same power is much less than with steam reciprocating machinery.

It follows from what has been said that under the present tonnage laws an owner who fits modern machinery will generally not be able to make his propelling space 13 per cent. of the gross. In consequence, his net tonnage will be much greater than if he had fitted the ship with ordinary steam engines. It is true that some cargo space is gained on account of the smaller propelling space, but the increase in net tonnage is out of all proportion, so much so that the increased freight is not sufficient to balance the increased dues, hence, apart from the increased economy of the modern machinery, the owner is losing. This is a state of affairs which should not be allowed to continue, and while there may be difficulty in altering the tonnage laws at the present time, they should be altered so that the progressive owner is not penalised.

PUBLICATIONS RECEIVED.

[*A short notice of any publication does not necessarily preclude the subsequent appearance of a longer review.*]

The Design of Marine Engines and Auxiliaries. By Edward M. Bragg, S.B. 110 illustrations and folding plates. London: Constable & Co., Ltd., 10, Orange Street, Leicester Square, W.C. 2. $6\frac{1}{4}$ in. × $9\frac{1}{4}$ in. × $\frac{7}{8}$ in. 183 pp. Cloth, 12s. 6d. net.

In view of the action of the North-East Coast Institution of Engineers and Shipbuilders in drawing up a guidance specification for reciprocating triple expansion marine engines for cargo vessels, and the great impetus given to the manufacture of these engines as a result of the war, the appearance of this book is very opportune. That the guidance specification represents the best modern practice

on the Tyne goes without saying, but whether this is in accordance with the many theoretical considerations which underlie the design of steam engines is another question. In the development of any type of machinery the results of theory and practice are both of importance. Theories are advanced to account for certain phenomena, and as a result practical methods are improved; or in certain circumstances the investigations and inferences of the scientist lead to entirely new processes in the realm of practice, and only when theory and practice progress side by side are the best results obtained. Especially is this true in the case of the development of the marine engine and its auxiliaries, and this book has a particular value because of the admirable manner in which it links together the theoretical and the practical side of the subject, thus enabling the designer to work in agreement with both the best-known theoretical rules and the many empirical formulæ arrived at from the proved results of modern practice.

Although the book is American in origin, the author, who is the Professor of Naval Architecture and Marine Engineering at the University of Michigan, is as well versed in the many contributions made to his subject in papers read before the various engineering institutions on this side of the Atlantic as he is in those from the other side, and readers will find that reference is made to most of the notable papers read in recent years which have any relation to the subject in hand.

Divided according to the American plan into sections, the first three are devoted to the main engines, dealing with "the determination of cylinder dimensions," "the design of engine parts" and "engine balancing" respectively, whilst the remaining two sections are devoted to "condensers and air pumps" and "turning engines and reversing gears." It is in the first two and the last sections that design must be guided mostly by the results of modern practice, but the results achieved in the direction of balancing reciprocating engines have depended almost entirely on mathematical theories. There is quite a large literature upon this subject, and it would be difficult to find a more concise and useful summary of this than that which is contained in this section.

The design of condensers and air pumps is of great importance in view of the proved value of high vacua, although the treatment of this subject is far more complete than need be in view of the fact that the author considers only the design of the reciprocating engine and its auxiliaries, and it is well known that a simple cylindrical surface condenser with single wet air pump is ample to create the vacuum required for economical working of this type of engine. The various experiments dealing with the effect of air on condensation, the effect of increasing the velocity of condensing water, &c., are effectively considered, and this section is worthy of close study in view of the great value of the highest vacua in conjunction with steam turbines.

The book is excellently produced, the illustrations being clear and the diagrams well drawn; there are in addition to other smaller plates, three large folding plates giving drawings of triple expansion engines of different sizes, made by the Newport News Shipbuilding & Dry Dock Company, of Newport News, Va., which will prove of value for purposes of reference when the design of the various details is being considered. In view of the development in the building of reciprocating engines for cargo boats, the book meets a long-felt want, and we recommend it not only to those who will be occupied with the problems of design, but also to those who are likely to have to deal with the running and maintenance of these engines, and who desire to be fully conversant with the most up-to-date knowledge concerning them.

Science and Industry: Industrial Research in the United States of America. By A. P. M. Fleming, M.I.E.E. London: His Majesty's Stationery Office. 7¼ in. × 9¾ in. × ¼ in. 60 pp., with illustrations. Price, 1s. net.

Scientific and industrial research, which has done so much to make the industrial fortune of Germany, has now been introduced into the commercial equipment of the United States, and it is necessary to ask whether this country can afford to dispense with an advantage which has already proved so fruitful in the hands of our most intelligent and powerful competitors. It is not enough for us to realise that we must follow the lead set by our commercial rivals, we must immediately consider how best this work of industrial research can be developed in this country. To this end the Advisory Council for Scientific and Industrial Research is publishing a series of papers of which the memorandum under review is the first. Mr. Fleming, who is well known for his work in the service of industrial efficiency, furnishes us with a record of the work which is actually being done in the United States, thus serving the double purpose of showing how great is our deficiency in this important branch of industry, and suggesting directions in which research work might be developed in this country. In the United States, industrial research is carried out by private corporations, by associations of manufacturers, universities, national institutions and scientific societies, and the first part of the book contains descriptions illustrated with no fewer than 85 plates of the laboratories in which the work is carried out; in the second part the author shows what steps are taken in order to train men for the important positions in these laboratories and also what is being done in the way of endowments for scientific research. In the closing sections of his paper Mr. Fleming discusses a number of fundamental questions which his experiences in the States have raised in his mind, and which his readers will be no less likely to ask. To some of them he suggests answers which cannot fail to stimulate thought and discussion, and if they have this effect one of the principal purposes of the author will have been served. It is not too late in the day for us to inaugurate vast schemes of industrial research, and we shall at least be able to profit from the mistakes of our rivals, the greatest of which, as demonstrated by this book, is lack of co-ordination between the various laboratories. It is to be hoped that the scheme which the Advisory Council will draw up will be of a national character, and one which, whilst it will deal with every branch of our national industries, will prevent any duplication of labour or overlapping.

WHEAT FREIGHTS.

In the House of Commons on Wednesday, July 11, Sir Walter Runciman asked the Chancellor of the Exchequer (1) whether he had recently ascertained that British vessels now under Blue Book rates were being used by the Government for Government account to bring to this country across the Atlantic wheat at 19s. per quarter and barley at 20s. per quarter entered on their bills of lading; whether these rates were charged by the Government or were fixed by the owners of the vessels; whether, while framing the proposals embodied in the Finance Bill, he found any instance of private shipowners or shipping companies charging 19s. or 20s. for these cargoes from the United States or Canada; and, if so, would he give the names of the companies charging those rates. Also whether his attention had been called to British vessels now arriving in the United Kingdom with wheat from America for consumption here, for the carriage of which the shipping companies received Blue Book rates, namely 11s. per gross ton, or 6s. per deadweight ton, on time charter; whether the bills of lading were made out for Government account at 19s. per quarter, or over 88s. per ton; whether the British bread consumer got the benefit of the low Blue Book rates, and in what way, or bore the burden of the 88s. per ton; and, if the latter, did the Exchequer get the difference between the two, or did it become a perquisite of the exporter or importer, or did they divide it between them?

Sir L. Chiozza Money replied: My right hon. friend has asked me to reply to these questions. As he is no doubt aware, all grain imported into this country is brought on Government account. The bill of lading rates on wheat and barley are made out as stated in the questions, but they do not affect the price at which the grain is sold in this country. In the adjustment of accounts between the Ministry of Shipping and the Royal Commission on Wheat Supplies, the latter are charged the assessed cost over all of actually transporting the grain from the various ports of shipment to this country. I may add that these arrangements had already been made before the Finance Bill was framed.

Mr. McKenna: Can the hon. gentleman state what is the reason for charging to the Wheat Commission 13s. a quarter more freight for wheat imported by the Commission than is actually paid to the shipowners?

Sir L. Chiozza Money: I am afraid that my right hon. friend did not perfectly apprehend the answer I gave. If he reads it in the Official Report he will find that that charge is not made. The Wheat Commission merely pays the actual cost. There is a very

good reason for the nominal book-keeping entry referred to in my answer, and I hope my right hon. friend will allow me to give him that privately.

Mr. Flavin: Will the hon. gentleman state what is the present freight for Indian meal from the Argentine. Is it not over £7 a ton ?

Sir L. Chiozza Money: As a matter of fact, the consumer, at the present time, merely pays the actual cost of bringing wheat to this country.

Mr. McKenna: Is there any private reason which cannot be made public for the Shipping Commission being credited with profits which it does not actually make ?

Sir L. Chiozza Money: It is not possible for me to give a fuller answer than that already given. I shall be very pleased to do so privately.

Mr. McKenna: Is there any reason why my hon. friend cannot state publicly why the Shipping Commission is credited with profits which it does not make ?

Mr. Houston: Is not the explanation that the Government and not the shipowner is profiteering in the people's food ?

Sir L. Chiozza Money: The consumer pays merely the cost of bringing the wheat to this country, and the nominal rate referred to by my right hon. friend is merely a book-keeping entry.

Sir C. Henry: Will my hon. friend give any other hon. member the information privately ?

Sir L. Chiozza Money: With very great pleasure.

STEAMERS AND BARGES FOR MESOPOTAMIA.

In the House of Commons on Wednesday, July 11, Mr. King asked the Secretary of State for India whether it was with his knowledge and sanction that in the autumn of 1915 Sir John Biles went direct to the builders of the *Medjidieh*, belonging to Lynch Brothers, and obtained a copy of the plans of the steamer; whether the India Office was aware that the barges and steamers supplied did not comply with the requirements of the military authorities in Mesopotamia; what was the total cost incurred in building and sending those steamers and barges; and whether Sir John Biles was still employed, and on a commercial basis, by the India Office as their naval architect.

Mr. Chamberlain (in a written answer) replied: I understand that Sir John Biles expected to obtain the design of the *Medjidieh* from the builders, and I was not and am not aware that there was anything unusual or unprofessional in this. The design was the property of the builders, was 33 years old, and save as to general outline was of little practical value for the construction of a modern vessel. The steamers supplied complied, so far as was practicable, with the specifications received from Mesopotamia, and are to-day running satisfactorily on the Tigris. Others of the same type have since been built for the expedition by the War Office. The barges were reported not to be suitable for the purpose for which they were ordered, but are now in constant use on the upper reaches of the river. The cost of the six steamers as delivered in this country was about £294,000. The cost of navigating them to Mesopotamia was about £11,500. The cost of the 43 barges was about £250,000. They were mostly shipped as part cargo in enemy vessels controlled by the India Office, and the cost involved in carrying them is not at present available. The answer to the last part of the question is in the affirmative, and Sir John Biles is now employed by the War Office in constructing river craft for use in Mesopotamia.

We deal, on page 50, with Mr. Chamberlain's comments on the omission of the Mesopotamia Commission to call Sir John Biles as a witness. These were made in the course of the debate on Thursday, July 12, in which Mr. Chamberlain intimated his decision to resign the office of Secretary of State for India.

SCREW PROPELLERS.

To many the subject of propellers is one of considerable difficulty, but the writer considers it possible to present the existing experimental data on the subject in such a form that the particulars of the screw which will best fulfill stipulated conditions of revolutions, power and speed, may be obtained with comparative ease.

In introducing the subject a number of terms peculiar to screw propellers must be explained:—

(1) Diameter, D ... The diameter of the circle swept by the tips of the blades during their revolution.

(2) Pitch, P ... The driving face of a propeller is a portion of the surface generated by a line at an angle with an axis, revolving about this axis and advancing parallel to it. The pitch is the distance this line moves parallel to the axis during one complete revolution, the forward and angular velocity remaining constant through that revolution. Or again, the pitch is the distance which the screw would advance in one revolution if it worked in a solid nut.

(3) Pitch ratio, $\frac{P}{D}$ ... The ratio of the pitch to the diameter.

(4) Face pitch ... That commonly accepted as the pitch of a propeller; the pitch of the driving surface of the screw.

(5) Nominal pitch ... Another term for face pitch; used by Froude in his 1908 paper.

(6) Effective pitch The complete pitch of the screw, taking the pitch of the back of the blade into consideration as well as that of the face. In this the point of zero thrust is taken to determine zero slip. Peculiar in application to one set of propeller curves, viz., Froude's 1908.

(7) Speed of screw, $V\rho$ The distance which a screw would advance in one hour were slip absent, or in knots $\frac{\text{Pitch} \times \text{Revolutions}}{(101{\cdot}3)^3}$

(8) Disc area ... Area of the circle swept by the tip of the blades.

(9) Expanded area, A_E The sum of the areas of all the blades, excluding the boss.

(10) Projected area, $A\rho$ The sum of the areas of all the blades projected in an athwartship plane.

(11) Disc area ratio, D.A.R. The ratio of the expanded area to that of the disc.

(12) Slip ratio, apparent, Sa. This is commonly called the slip and is expressed as a percentage of the speed of the screw, $V\rho$. Thus, if V be the speed of the ship, then $\frac{V\rho - V}{V\rho} = Sa$.

(13) Slip ratio, real, Sr The real slip of the screw, taking wake into account, expressed as a percentage of the speed of the screw $V\rho$. Thus, if Vc be the speed of the ship corrected for wake, then $\frac{V\rho - Vc}{V\rho} = Sr$. In model screw experiments the slip referred to is always *real* slip as the model propellers have been run unattached to ship model.

(14) Leading edge ... The edge of the blade which first meets the water when a ship is moving ahead.

(15) Following edge — The opposite edge from the leading.

(16) Driving surface — The after surface of the blade, or that which drives the water aft, commonly called the face.

These are the principal terms in use. Others requiring explanation will be treated as they arise.

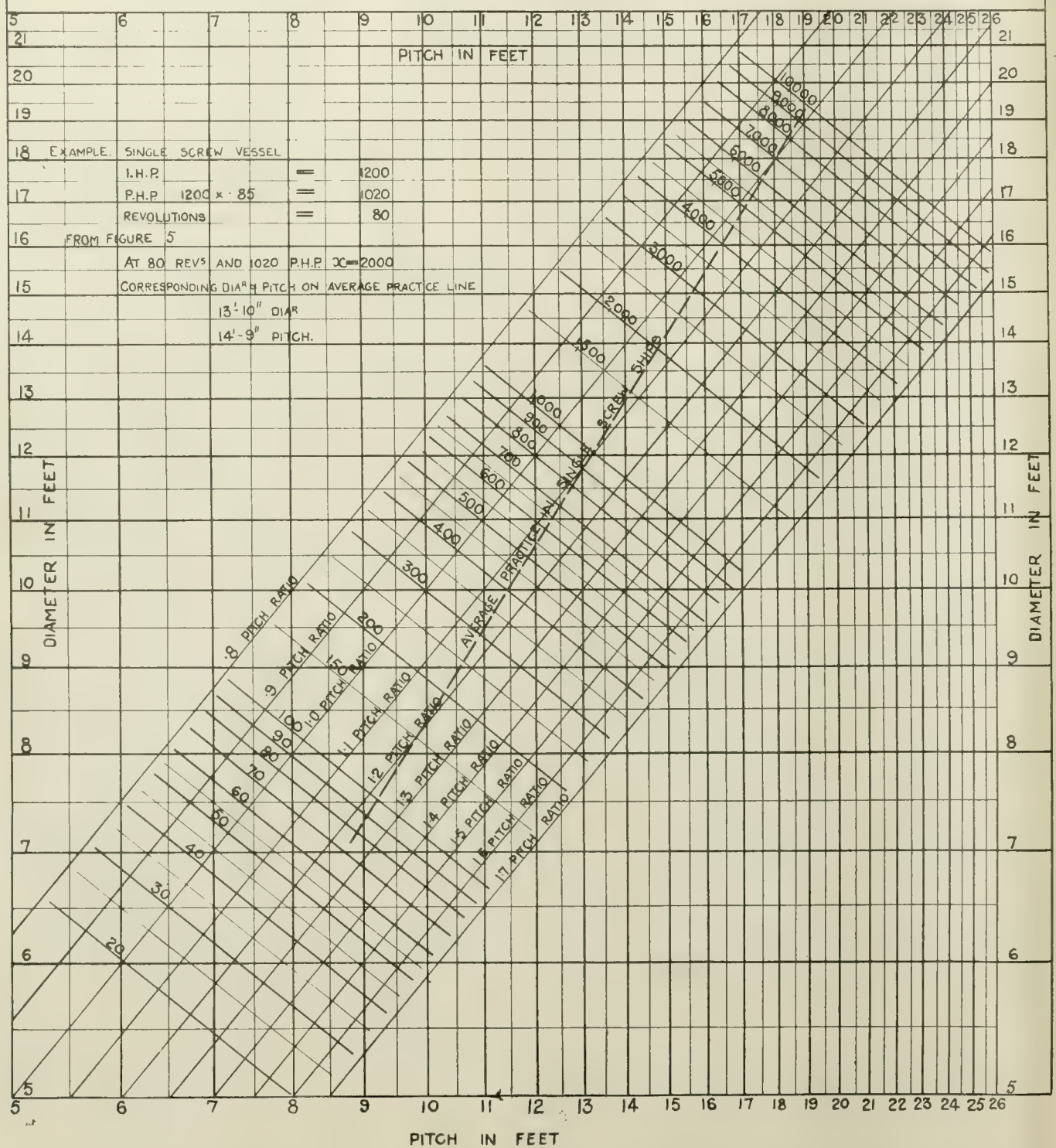
Propeller action.—At one time the impression was general, and still holds in some quarters, that the screw propeller is an instrument

FIGURE 1

DIAGRAM GIVING APPPOXIMATE DIAMETERS & PITCHES OF 4 BLADED PROPELLERS FOR SINGLE SCREW SHIPS

SEE FIG 5 FOR VALUE APPROPRIATE TO A GIVEN NUMBER OF REVOLUTIONS AND STATED PROPELLER H.P.

PROPELLER HORSE POWER OR P.H.P. = ·85 I.H.P. OR ·97 S.H.P.



(17) Back of blade ... That seen by the observer looking from forward to aft.

that cuts its way by screwing itself into the water and thus causes the ship to advance. The propeller, therefore, which could do

this with the minimum of slip was reckoned to have reached the maximum efficiency. Negative slip was considered a great achievement, as evidently the propeller was driving the ship ahead at a faster rate than the screw itself was advancing. It has, however, been clearly established that the screw propeller is a reaction machine and that the water acted on by the screw is accelerated in a sternward direction. Or, as Baker puts it, "A screw propeller is a means of pushing a ship forward by thrusting water aft."

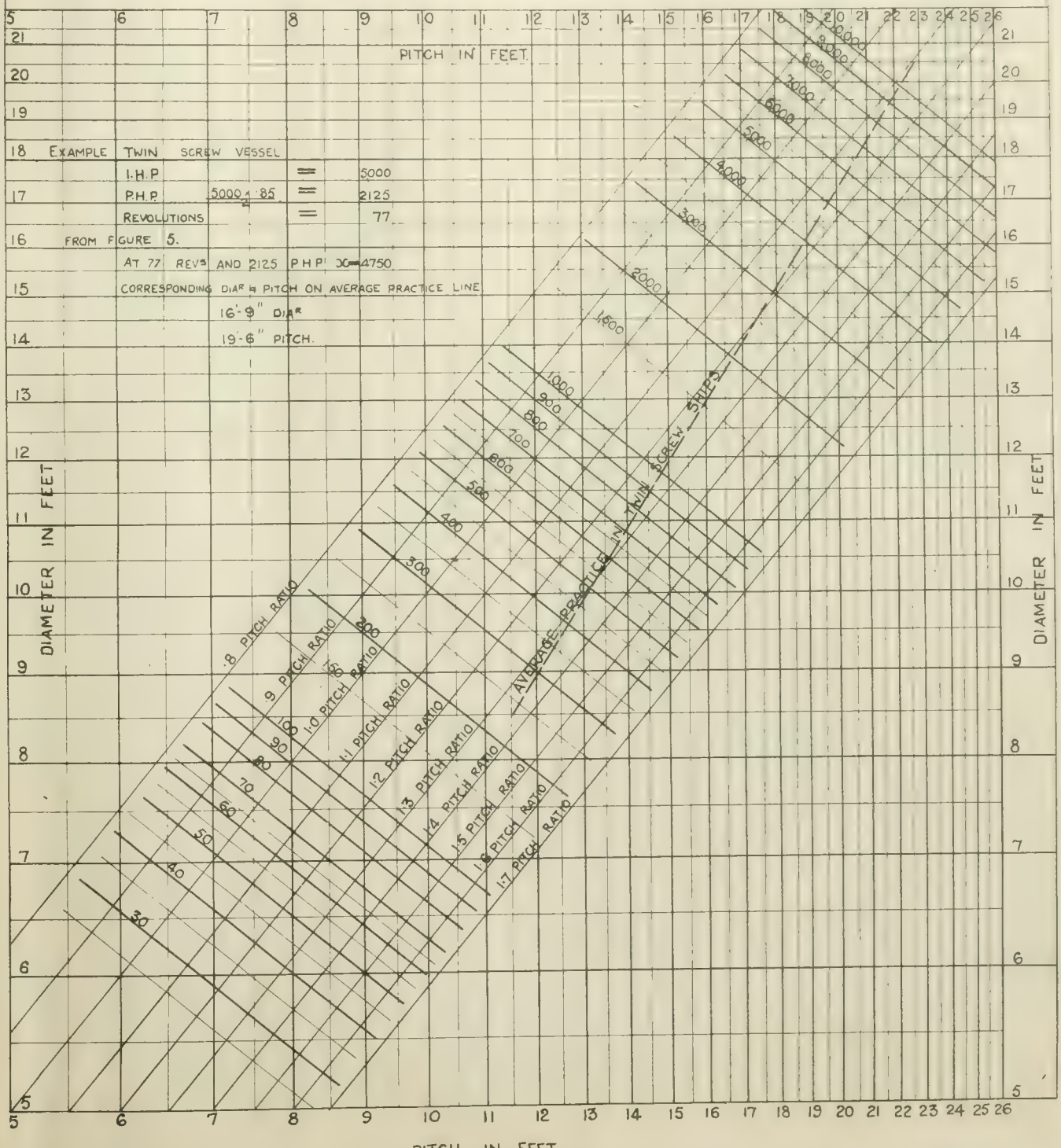
Experimental work on model screws. Whilst many valuable contributions had been given on the subject under discussion, it was not until the undertaking of experiments with model screws was accomplished that much useful information was gleaned of

FIGURE 2

DIAGRAM GIVING APPROXIMATE DIAMETERS & PITCHES OF 4 BLADED PROPELLERS FOR TWIN SCREW SHIPS

SEE FIG 5 FOR VALUE APPROPRIATE TO A GIVEN NUMBER OF REVOLUTIONS AND STATED PROPELLER H.P.

PROPELLER HORSE POWER OR P.H.P. = .85 I.H.P. OR .97 S.H.P.



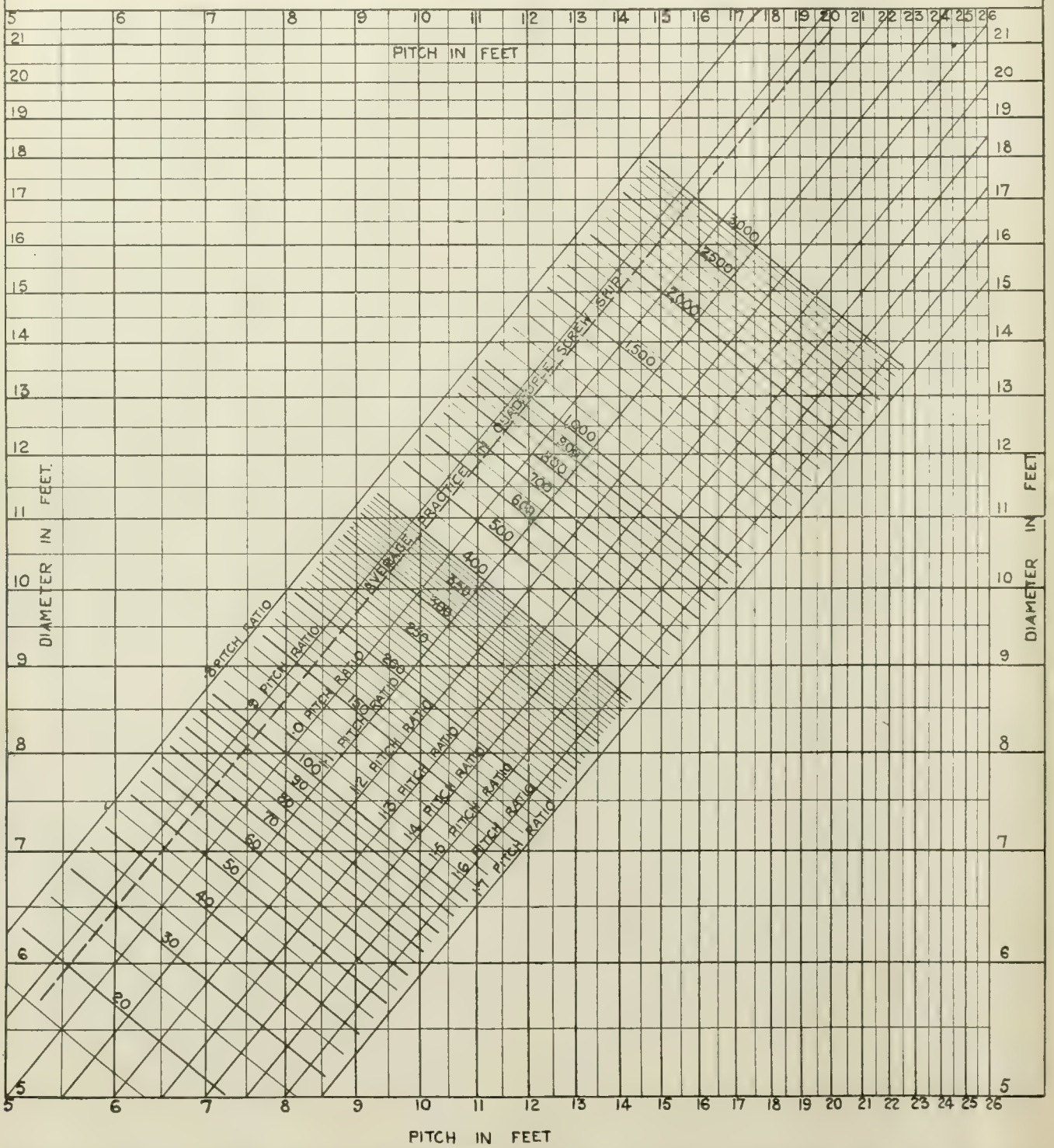
their potentialities. Several experimenters have covered large fields of investigation and a great mass of data is now at the disposal of engineers and shipbuilders. In subsequent articles the writer hopes to refer to the principal experiments which have been made and will show how propeller design can be proceeded with from the data available.

Approximate methods.—It is probably the case that the majority of those responsible for the determination of the dimensions and design of screws rely more on past experience and actual trial results to guide them than on experimental data. From considerations of the apparent slip the pitch is determined, and by using some method of constants of performance, the appropriate diameter can

FIGURE 3

DIAGRAM GIVING APPROXIMATE DIAMETERS & PITCHES OF 3 BLADED PROPELLERS FOR QUADRUPLE SCREW SHIPS SEE FIG 5 FOR VALUE APPROPRIATE TO A GIVEN NUMBER OF REVOLUTIONS AND STATED PROPELLER H.P.

PROPELLER HORSE POWER OR P.H.P. ·85 I.H.P. OR ·97 S.H.P.



be given. In the present article the writer draws attention to the accompanying sets of curves which he has developed and which will enable a ready check to be made on proposed dimensions to fulfil specified conditions of revolutions and power. These diagrams have been constructed from the actual trial results of scores of ships, and their utility is demonstrated in the examples given later.

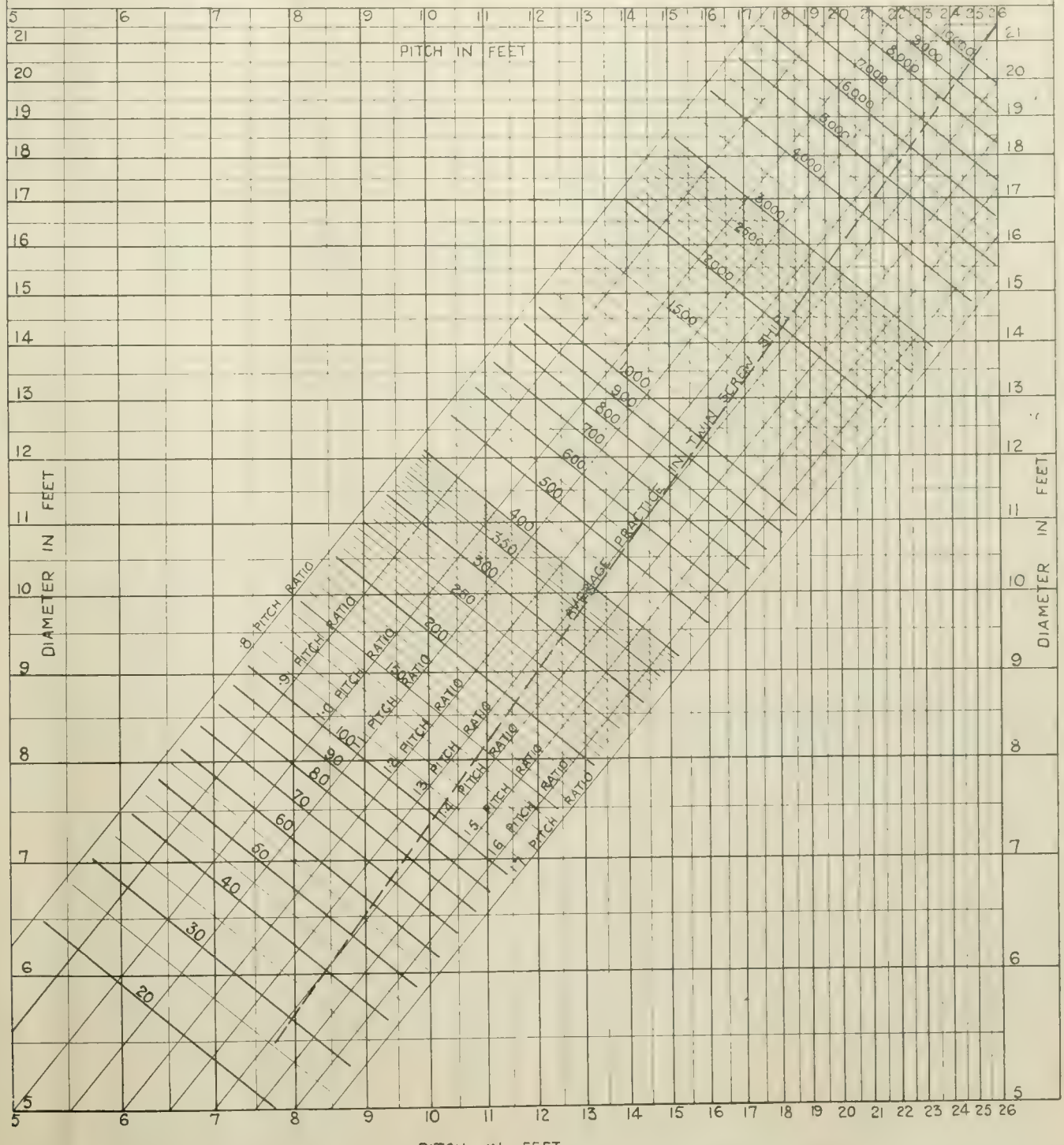
Basis of diagrams.—In the formulæ adopted by Taylor in his 1904 model screw experiments and by Curtis and Hewins in theirs of 1905, P or propeller horse power = cSD^2V^3; where c is a constant dependent on the number of blades of the screw; S = a power coefficient dependent on real slip, area and pitch; D = diameter and V = speed of ship corrected for wake.

FIGURE 4

DIAGRAM GIVING APPROXIMATE DIAMETERS & PITCHES OF 3 BLADED PROPELLERS FOR TWIN SCREW SHIPS

SEE FIG. 5 FOR VALUE APPROPRIATE TO A GIVEN NUMBER OF REVOLUTIONS AND STATED PROPELLER H.P.

PROPELLER HORSE POWER OR P.H.P. ·85 I.H.P. OR 97 S.H.P.



Substituting for V, the above formula may be expressed thus :—

$$P = cSD^2 \frac{p^3R^3(1-s)^3}{(101{\cdot}3)^3}$$

therefore—

$$\frac{P}{R^3} = cSD^2 \frac{p^3(1-s)^3}{(101{\cdot}3)^3}.$$

The propeller horse-powers obtained on the trials examined by the writer have been divided by $\left(\frac{R}{100}\right)^3$, so that the values given on Figs. 1, 2, 3 and 4 are PHP^s (or propeller horse-powers) for 100 revolutions for the complete range of propeller dimensions shown. The method of plotting adopted takes into account the diameter and pitch functions on the right-hand side of the equation, and certain S and $(1-s)^3$ values appear to be associated in practice with certain diameters and pitches of screws.

(To be continued.)

THE GERMAN "LLOYD'S."

It would seem that the scheme for an institution of a German "Lloyds" is not meeting with general approval in Teutonic Insurance circles. German companies, which appear to be amalgamating in the same way as the leading Fire and Marine Companies in this country, are strong in their denunciation of the proposition.

Their arguments are voiced by the *Munchener Neueste Nachrichten* in an article from an evidently inspired source. The chief complaint seems to be that a body composed of individual underwriters and brokers, with a guarantee deposit as low as £5,000, or thereabouts, would create so great a competition that rates would be cut to an unprofitable figure. It would also appear that any attempt to widen the German insurance market is to be discouraged, since the proposal of the Government to interest itself in insurance matters is criticised, on the grounds that the complexities of the business do not lend themselves to the method of State Department.

It looks as if the German Companies are determined to be entirely self-reliant after the war—Lloyd's itself is giving warning that German underwriters will not, in future, seek the advantage of its slightly lower rates for re-insurance, as they did for some years prior to the outbreak of hostilities. This warning is likely to fall on deaf ears, and it can be most properly regarded as the *tu quoque*, to the resolution passed by the London Institute of Underwriters, some months ago, dealing with the exclusion of German Insurances, both as risks and cover, as a precautionary measure in the trade war that must inevitably follow peace.

A further discussion of insurance prospects, in the article referred to, shows the writer to be optimistic in his views of the future of the business in Germany. With a proviso that an expanded market must perforce introduce an element of competition, which would reduce rates to an unremunerative state, he sees nothing but good in the future of Germany's insurance business.

The writer need have no fear of the market becoming too big for the business offered it, however. The attitude of British Underwriters, to which we refer above, and the closure put on German Companies by America, to which reference is made elsewhere in this issue, together with the joint action to which the Allies are pledging themselves more completely at every business conference will leave Germany without a market of any importance, outside her own boundaries, in which to distribute her surplus insurances. The trouble will be rather the reverse, and if Germany has an industrial status of any importance left, when the war is over, German insurance companies may find themselves hard put to it, to absorb all the risk which will be thrown on the market.

THE MEASUREMENT OF SHAFT HORSE-POWER.

The use of the steam turbine as a means of propulsion for all classes of steam ships, which bids fair to be considerably extended in the near future as a result of the successful application of gears for the reduction of the most economical speed of the turbine to the most economical speed of the propeller, has rendered it essential that some simple means shall be found whereby the horse-power developed by the turbine can be measured. At the present time there is no direct method similar to the simple and straightforward "indicating" of the reciprocating engine that can be used for determining the horse-power of the turbine, and hence indirect methods must be resorted to. A rough approximate computation can be made, based upon comparison with the known performance of similar machines, or in the case of turbines utilised for driving electric generators, the output of the generator can be measured and, making allowance for the efficiency of the generator, the horse-power developed by the turbine is arrived at.

For marine work, the method adopted consists of a determination of the horse-power being transmitted through the tunnel shaft between the turbine and the propeller, by measuring the angle of twist of a known length of the shaft, the result being known as the "shaft horse-power." It can be readily shown that the angle of twist or angle of torsion varies directly as the power transmitted by the shaft, and inversely as the speed of rotation. Let

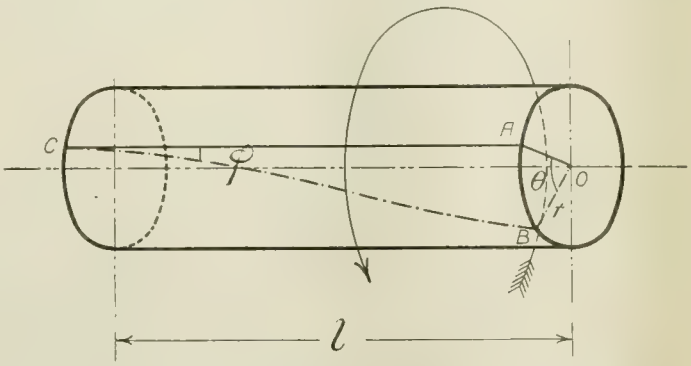


Fig. 1.—Diagram showing Effect of Torsion.

Fig. 1 represents a length l of a shaft transmitting a horse-power H.P. at a speed of N revolutions per minute in the direction shown. The material of the shaft is subjected to a pure shearing stress as a result of the torsion in the shaft, and the line which was originally in the position CA moves round to CB, CB being a portion of a helix. The radius OA at the same time moves round to OB, so that the angle AOB$=\theta=$ angle of torsion of the length l.

But modulus of rigidity $C = \frac{\text{shear stress,}}{\text{shear strain,}}$

hence, if f = max. shear stress in the material of shaft $C = \frac{f}{\frac{AB}{l}}$

since shear strain $= \frac{AB}{l}$ But $\frac{AB}{OB} = \theta$ or $AB = r\theta$.

$$\therefore C = \frac{f}{\frac{r\theta}{l}} = \frac{f}{\frac{d\theta}{2l}} \quad \text{or} \quad \theta = \frac{2fl}{dC} \qquad \text{(i)}$$

But it is proved in any text-book dealing with the theory of shafts that for a solid shaft of diameter d

$$T = \frac{\pi}{16} d^3 f$$

where T is the twisting moment producing the stress f. Hence substituting the value of f obtained from this equation, *i.e.*, $f = \frac{16T}{\pi d^3}$

in equation (i) we get $\theta = \frac{32Tl}{\pi d^4 C}$ (ii)

But the horse-power transmitted by the shaft at N revs. per min. sets up a twisting moment T in the shaft such that

$$\text{H.P.} = \frac{2\pi N T}{33{,}000} \quad \text{or} \quad T = \frac{33{,}000 \text{ H.P.}}{2\pi N}$$

The unit of twisting moment as obtained from this formula is the lb. ft. This must be expressed in lb. ins. since modulus of rigidity and diameter of shaft are expressed in inch units. Hence we have

$$T = \frac{33{,}000 \times 12 \times \text{H.P.}}{2\pi N} \text{ lb. ins.}$$

Substituting this value of T in equation (ii) we get

$$\theta = \left(\frac{32 \times 33{,}000 \times 12 \times l}{2\pi \cdot d^4 C}\right) \frac{\text{H.P.}}{N} \qquad \text{(iii)}$$

But for any given shaft l, d, and C are constants

$$\therefore \theta = \text{constant} \times \frac{\text{H.P.}}{N} \qquad \text{(iv)}$$

and a similar result would be arrived at if the foregoing investigation had been made for a hollow shaft instead of for a solid shaft.

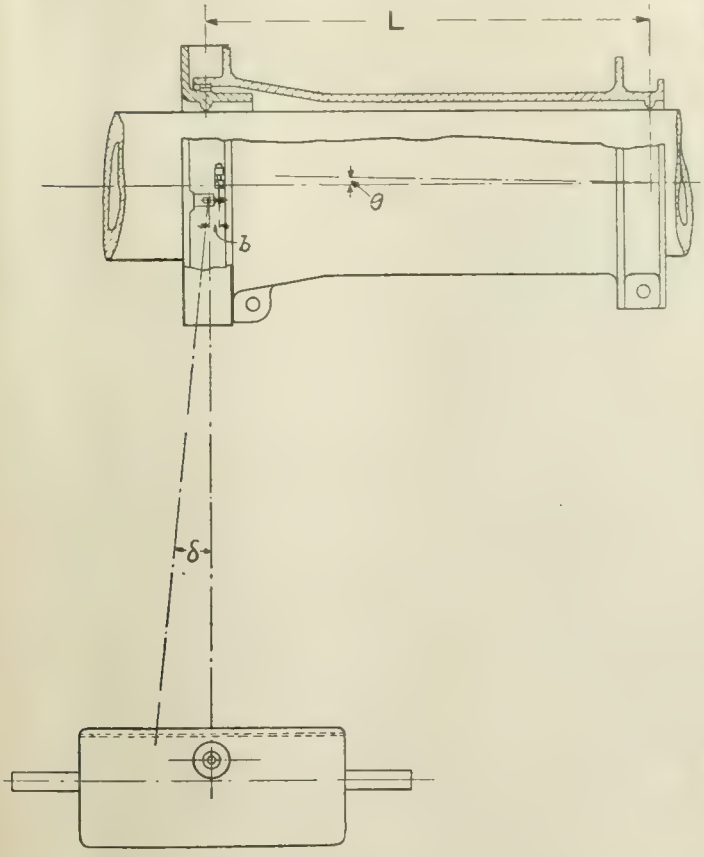


Fig. 2.—Diagram of Torsionmeter showing Arrangement of Flanges.

Hence in either case, having determined the constant of the formula, the horse-power can be directly determined from a measurement of the angle of twist of a given length of the shaft.

The instrument used to measure this angle of torsion is called a torsionmeter, and in most types on the market consists essentially of two collars clamped rigidly to the shaft at a given distance L apart, as shown in Fig. 2. The second of these collars is provided with a sleeve and a flange at the end of the sleeve, which is thus brought up close to the first collar, which carries a similar flange, the sleeve overlapping the first collar on which it is supported, usually on roller bearings, to keep it concentric with the shaft. Both the collar and the sleeve are quite rigid, and it is therefore obvious that when the shaft is twisted by the transmission of power, the flange on the sleeve will move relatively to the flange on the first collar, the movement being equal to that between the two parts of the shaft to which the collars are clamped. Actually the relative movement of the flanges is very small, and it is in the means adopted to multiply and measure this relative movement that the various types of instruments differ.

In the Hopkinson-Thring torsionmeter (see Fig. 3), made by Siemens Bros. & Co., Ltd., and designed by Professor Hopkinson, in conjunction with Mr. Thring, the principle adopted consists in the observation of the twist by means of two beams of light projected on to a scale from a fixed and a movable mirror. It is of interest to note that a somewhat similar result was arrived at independently, although at a later date, by Hermann Frahm, of

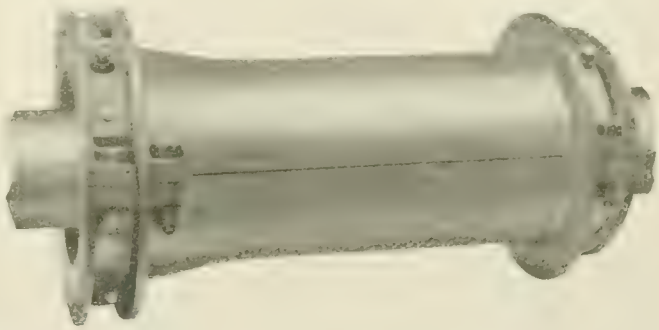


Fig. 3.—Hopkinson-Thring Torsionmeter.

Hamburg. The beam projected on to the scale by the fixed mirror is taken as the zero point, whilst the beam projected by the movable mirror indicates the amount of torque on the shaft. Both mirrors rotate with the shaft, but even at moderate speeds the reflections appear as continuous lines of light across the scale, Fig. 4, and there is thus no difficulty in taking the readings. The fixed mirror is attached to the flange on the first collar referred to above, and the movable one is attached to the flange carried by the sleeve. The fixed mirror is adjusted so that the beam of light reflected from it is received at the same point on the scale as that from the movable

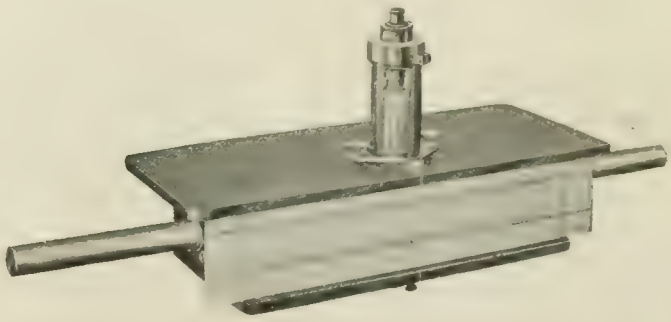


Fig. 4.—Indicator for Hopkinson-Thring Torsionmeter.

mirror when there is no torque on the shaft. If the position of the apparatus becomes altered relatively to the scale owing to the warming up of the shaft or from other causes, this is indicated immediately to the observer by an alteration in the position of the zero as reflected by the fixed mirror. Hence the scale zero may be adjusted, if desired, by moving the scale so that its zero coincides with the reflection from the fixed mirror, but this is not necessary to obtain a correct result, since the mean of the two readings will be the same.

The constant of the instrument, viz., the factor which when multiplied into the product of the torsionmeter reading and the revolutions per minute gives the horse-power may be determined either by calculation or by experiment. It is determined by calculation from the various quantities given in formula (iii) above, modified if necessary in the case of a hollow shaft, together with a factor

giving the relationship between the scale reading and θ the angle of twist of the shaft; but a direct calibration of the shaft with the instrument in position is recommended, this being made before the shaft is put in the ship by applying a known twisting couple.

The angle of twist of the shaft is equal to the angle between the two beams of light. If this angle is small, it is approximately proportional to the scale reading.

We have seen that

$$\theta = \text{constant} \times \frac{\text{H.P.}}{\text{N}} \qquad \text{(iv) above,}$$

i.e., H P = constant $\times$ N θ; and since θ is proportional to the scale reading,

H P = constant $\times$ revs. per min. $\times$ scale reading.

The value of the constant is best determined for different values of the twisting couple, these being in approximate agreement, and the average value taken for use when the instrument is in service on board the ship. If, however, the torsionmeter is applied to existing shafts, where it would be impossible to make direct readings in order to obtain the constant, this can only be determined by calculation, as shown above.

By a combination of mirrors it is possible to obtain more than one reading of the torque in the shaft during each revolution, but it will be apparent that this instrument is only suited to deal with shafts in which the twisting movement is uniform, as in turbine

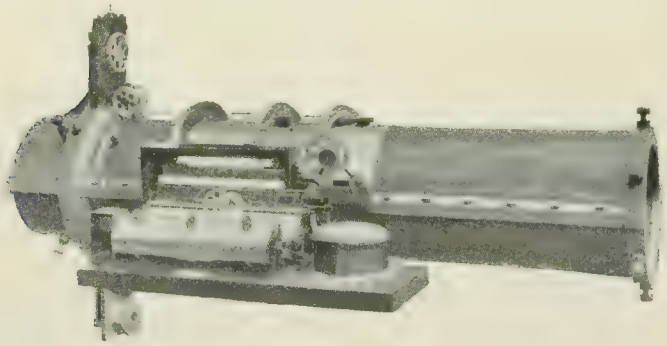


Fig. 5.—Denny-Edgecombe Torsionmeter with Indicator and Recorder.

shafts, as in the event of a reading being made when the torque was very much different from the average value, the shaft horse-power arrived at would be correspondingly inaccurate.

Another form of instrument is the Denny–Edgecombe torsionmeter, made by Denny Brothers, of Dumbarton, the principle of which is the same as that already described, but which differs in the means adopted for measuring the relative displacement of the two flanges. Each of the flanges carries two similar and similarly situated arms, and when the shaft is twisted, the sleeve remaining rigid, there is a transverse displacement of the arms carried by the flange attached to the sleeve, relatively to those carried by the other flange, the displacement corresponding to the twist of the shaft between the two collars. One of the arms has a short rack of involute teeth on its periphery, the other carries an enclosed multiplying gear, the pinion of which can be accurately adjusted to mesh with the rack. This multiplying gear is really a set of toothed levers which have small angular movements upon their centres, but for convenience they are made in the form of wheels, both for accuracy of manufacture and for balance. There are only two spindles, one carrying the pinion which gears with the rack; the other has the final angular movement which it is desired to measure. In the type of torsionmeter represented by Fig. 5, a mechanical contrivance is adopted for measuring the angular movement of this second spindle, there being fixed to it a balanced drum about 4 ins. in diameter, as shown. To this drum there is secured by both ends a flexible wire rope, which passes from the drum down the arm round a pulley along the sleeve, round a horizontal pulley on the sleeve and back again to the drum, to which it is securely fastened, the pulley on the sleeve being adjustable in order to tighten the rope. Thus the circular motion of the second spindle is converted into a longitudinal movement of the wire rope. A light aluminium traveller runs on rollers along a turned part of the sleeve, one pair of its rollers being made to run in a V-groove cut in the sleeve, thus permitting the traveller to move along the sleeve, but causing it to revolve with the sleeve. The traveller has a turned flange and a gripper, by means of which it can be rigidly secured to either part of the wire rope in any desired longitudinal position. It is evident that when the shaft twists, the multiplying gear is moved, and the traveller moves along the sleeve an amount which represents the torsion of the shaft.

There may, however, be a slight longitudinal movement of the whole shaft due to expansion or other causes, and it is therefore necessary to measure the movement of the traveller relatively to the sleeve. For this purpose there is cast upon the sleeve a base flange, which is turned to the same diameter as the traveller flange. This forms the base of measurement and also serves as a means of accurately setting the traveller on the sleeve, the two flanges being brought together for this purpose, so that when the traveller is secured to the wire rope, the difference of position which occurs between the two flanges represent torsion accurately. A suitable indicator is attached to the traveller, which multiplies the motion fourfold, and thus a more accurate measurement of the relative displacement of the two flanges—and therefore of the twist of the shaft—is obtained. The indicator consists essentially of a base plate which is free to move longitudinally on ball bearings in its case and which carries at the left-hand corner a wheel which runs on the base flange and which is kept in contact with it by a spring so arranged that the indicator base plate follows any longitudinal motion of the base flange and eliminates everything but torsion. Mounted on the base plate is a small movable carriage which carries at the back a similar wheel running on the traveller flange; this flange and wheel are kept in contact by another spring arranged on a fusee to give constant tension to all positions. On the front of the carriage there is a pair of concentric toothed wheels, the smaller of which gears with a fixed rack on the base plate, the larger gearing with a movable rack running in ball bearings, also on the base plate; the longitudinal movement of this rack being four times that of the carriage and traveller flange. The rack carries a pointer which moves over a horizontal scale fixed to the base plate, and so registers torsion. In order to increase the fineness of the reading, a small spindle is geared to the edge of the larger toothed wheel, and this moves a pointer round a fixed circular disc, one revolution of this pointer corresponding to two divisions on the fixed scale.

If it is desired to obtain a permanent diagram of torsion, a recorder may be attached to the front of the indicator as shown in Fig. 5, the drums of which are driven by means of small double worm gear from the spindle of the wheel which runs on the base flange, change gear actuated by a small lever being provided so that the drums can be kept revolving in the same direction whether the ship is going "ahead" or "astern." A diagram paper is fixed to the drums upon which pens attached to the fixed scale and to the movable rack of the indicator mark respectively the zero line and the torsion line. In addition to this, a clock is fitted with an electrical arrangement for making half seconds, and another electric pen is provided, which can be connected with a make-and-break fitting on the revolution counter of the engine. A diagram of simultaneous revolutions per minute and torsion is thus obtained, from which the shaft horse-power and any or every instant during the trial can be obtained.

It will be noticed that it is the mean torsion which is given by this instrument and not the torsion at any one point of a revolution taken as the mean. As in the type of instrument previously described, having determined the constant either by direct experiment on the shaft or by calculation, the shaft horse-power is determined from the formula

S.H.P. = Constant $\times$ revs. per min. $\times$ scale reading.

(*To be continued.*)

GENERAL NEWS SECTION.

PERSONAL.

Mr. John James Bowen, late of the Cardiff branch of Sir R. Ropner & Co., Ltd., who died on June 18, left estate of the gross value of £178.

Mr. W. H. Seager (Tempus Shipping Company), Cardiff, is defraying the cost of the erection of five seats for the sole accommodation of wounded soldiers and sailors. The seats are being put in various places.

Sir Eric Geddes, K.C.B., who was in May last made the head of a new department of the Admiralty with the title of Controller, and with the honorary and temporary rank of Vice-Admiral, has now been appointed First Lord of the Admiralty in succession to Sir Edward Carson. Before coming to the Admiralty Sir Eric Geddes was largely responsible for the magnificent achievement in railway construction in France, which was a feature of last autumn's work behind the British front. A man of strong character and great administrative ability, he is only 42 years of age. He was originally intended for the army, but after passing the preliminary examination went to the United States, where he took up railway work on the Baltimore & Ohio. In 1895 he left America for India, where he became Traffic Manager of the Rohilkund & Kumaon Railway. That position he relinquished in 1904 on returning to England to become Claims Agent of the North-Eastern Railway. In 1911 he was appointed Deputy-General Manager of the Company. During the war he was first attached to the Ministry of Munitions, and in 1916 was appointed Director-General of Military Railways and received a knighthood. In his recent capacity as Controller at the Admiralty, he was responsible for meeting the combined requirements of the Admiralty, the War Office, the Ministry of Shipping and other Government Departments in respect of the design, construction, alterations and repairs of warships and other vessels of all classes, and the requirements of the Admiralty in respect of armaments and munitions. He was made a K.C.B. on the occasion of the King's Birthday.

Photo by [*Elliott & Fry.*

Sir Eric Geddes,
First Lord of the Admiralty.

It is reported that Sir J. B. Marshall, K.C.B., Director of Dockyards and Dockyard work since 1906, has accepted the position of Deputy-Chairman of J. S. White & Co., Ltd., shipbuilders, Cowes, Isle of Wight.

The death occurred, on July 16, at Gilsland, Cumberland, of Sir Charles Stamp Milburn, Bart., a director of the well-known shipowning firm William Milburn & Co., Milburn House, Newcastle. He had been in indifferent health for some time. The large business with which he was connected was established by his grandfather, William Milburn, and on the death of his father, the first baronet, Sir John Milburn, in 1907, he succeeded to the title. Sir Charles was only 39 years of age and was unmarried. The baronetcy falls to his younger brother, Second Lieutenant Leonard John Milburn, now serving in the Horse Guards, who has been on active service in France since the beginning of the war.

The funeral took place on Friday last of Mr. Alfred Chapman, Managing Director of Fawcett, Preston & Co., the widely-known firm of Liverpool engineers. Mr. Chapman, who was 78 years of age, joined the firm as an apprentice, and has thus been associated with it for a period of over 60 years.

The death took place on July 6, at Jersey, of Mr. Marcus Henry Matthews, who was formerly a well-known Cardiff shipowner and broker. Deceased was 70 years of age, and retired from business at the end of 1915, his shipbroking and coal export business being taken over by Cory & Blundell. At one time the style of the firm was M. H. & J. E. Matthews, and a cargo line of four or five steamers was run between London and Bristol Channel ports, which line was acquired by the London-Welsh Steamship Company, Ltd., of which Furness Withy & Co., Ltd., are the managing owners. The late Mr. Matthews was also formerly a partner in the firm of Matthews & Luff, of London, shipowners and brokers, and was connected with the old Phœnix Merthyr Colliery Company, Ltd. He was a native of London, and had business connections with London and Cardiff extending to nearly half-a-century.

The gallantry of a Sunderland pilot, William H. Alder, in having saved the lives of two seamen on November 22, 1916, in the Wear, has been suitably recognised. He has received at the hands of the Mayor of the Borough the Carnegie certificate, together with a cheque for £25, and the Royal Humane Society's certificate and medal. The two sailors were attempting to board the steamer *Camellia*, when one of them fell into the water between the quay and the ship, and the second man jumped in after his mate. Both were in danger of drowning when Mr. Alder slid down a rope and managed to save them after a hard struggle. The three of them were in great peril of being crushed to death between the steamer and the quay, apart from the risk of their all being drowned.

Mr. F. H. Lambert, J.P., of the firm of Lambert Bros., Cardiff, London, &c., has retired. He has for many years been one of Cardiff's prominent business men. For two years he was Vice-President of the Cardiff Chamber of Commerce, and in 1911 was President. Twelve months ago Mr. Lambert retired, on account of ill-health, from the position of managing director of the firm, but continued as a director. In view of recent developments it was thought that the present was a suitable opportunity for Mr. Lambert to carry out his desire to retire from the firm. He still retains his position as a partner in the firm of Lambert, Barnett & Co., shipowners, &c.

Mr. A. Beasley, who as we recorded last week, will shortly retire from the position of General Manager of the Taff Vale Railway, became General Manager of the Taff Vale Railway in 1891, having previously been in the service of the Great Western Railway Company for a period of no less than 34 years. During the 60 years of his railway employ, with the exception of the first year or two, when he was acquiring practical knowledge of station and other duties, he has been mainly concerned in matters of administration and management. Mr. Beasley has also been a great champion of dock interests. He practically founded the Bristol Channel Dock Owners' Association, which was formally inaugurated in 1905, and has been its President from that date until now. During that period many questions vitally affecting the interests of dock owners have required handling, and dock owners all over the country have reason to be grateful for the concessions which the vigorous policy adopted by the Association has secured for them. Just before the inauguration of the Association the Home Office wished to certify dock working as a dangerous occupation and to apply to docks certain factory regulations applicable to such trades. Mr. Beasley was the protagonist of the Bristol Channel Docks against those regulations, and successfully prevented the adoption of any which would have been dangerous and unworkable. He also took up vigorously the question of net tonnage. The Association, under his presidency, helped to secure for dock-owners the right to limit their liability for damage done to ships. It has also aided in redressing an inequality under which British shipowners, as well as dock-owners, suffered in the matter of net tonnage, by securing that a British ship sold to a foreigner should not reduce its net tonnage below what it was when British owned. Mr. Beasley lately took a prominent part in the recent successful movement for securing that dock and harbour authorities should receive some payment for Admiralty vessels using their ports, the concession of which principle was strongly resisted by the Government for some time. Mr. Beasley will not sever his connection with the Taff Vale Company altogether, but will be elected to a seat on the board.

Mr. A. Beasley,
General Manager, Taff Vale Railway, 1891–1917.

PORT NOTES.

Chemulpo.—The *Board of Trade Journal* states that at the end of February last four-fifths of the entire work in connection with the harbour improvement at Chemulpo had been completed, and the sea-wall had been almost entirely constructed. Work on the lock gates was started in April and was expected to reach completion by next October. Most of the material for the gates had arrived from the United States and an American engineer is now at the port surveying the work.

Port of Adelaide.—In connection with the deepening and widening of the Port Adelaide River, which is now in hand, the Harbours Board propose to improve the system of navigation lights, which were of an inferior and obsolete character. The Board intend to instal the "Aga" system of lighting, and by this means effect great economy in working expenses. It is intended to provide lights at regular intervals on both sides of the channel on the whole length of the river. The dredging operations in progress include the straightening of some of the worst bends in the river and the widening of the channel to a minimum width of 400 ft.; at present it is 250 ft. This, with the additional 4 ft. in depth which is to be made, will greatly assist navigation.

FINDING THE I.H.P. FOR STEAMSHIPS.

Mr. De Rusett's Replies to Criticisms.

Mr. E. W. De Rusett, who, on April 27 last, submitted a paper on "A Method of Finding the I.H.P. for Steamships" to the members of the North-East Coast Institution of Engineers and Shipbuilders, has now forwarded his written reply to points raised in the discussion. (The paper and discussion were reported in the *Shipbuilding and Shipping Record* for May 3, pp. 433 and 434, and May 10, pp. 457 and 458).

Mr. De Rusett thanks those gentlemen whose suggestions added to the usefulness and practicability of the methods he described. Prof. Welch and other speakers had suggested that the prismatic coefficient should be used rather than the block coefficient. They thought, also, that estimates of i.h.p. should preferably be made upon a basis of estimated resistance of ship rather than the trial horse power. He is aware that many naval architects prefer to work upon the prismatic coefficient; therefore, in Tables A and B, the coefficient of ⊠ had been inserted in each instance, so that the prismatic coefficient can be obtained and the subject considered from that standpoint. He does not see, however, that the results will be materially affected, as the area of the ⊠ section cannot, with advantage, be increased. For residuary resistance calculations, the prismatic coefficient, as stated by Mr. Cannon and others, may be the best guide, but for wake values, and therefore for effect on propulsion, the block coefficient appears to be the usual basis taken. The following considerations are, in his opinion, sufficient reason for preferring to work upon a basis of actual ship trials on the measured mile. The horse power on trial includes the influences of the ship's form, size and proportions on her resistance, also all the other influences concerned, such as engine friction, propeller efficiency and the effect of the ship's own lines and shape of bossings upon the flow of water to the propellers and, in addition, the effects of wind on the superstructure in all its variations and the effect of varying depths of water. When the resistance is estimated from the results of a tank trial and the propulsive efficiency $\frac{\text{effective horse-power}}{\text{indicated horse-power}}$ afterwards obtained from the sea trial, it is safe to assume that the propulsive coefficient so obtained forms an eminently practical basis for estimating the horse power of other ships of similar form and type of machinery. Mr. Bocler's statement that it had come to his notice that, with the same dimensions and displacement, there had been as much as 12 per cent. difference in resistance of two models, merely due to alterations in the lines, shows that considerable reductions may be made in resistance where there is time given to have experiments made during the initial stages of design. Mr. De Rusett certainly does not wish to be thought to question the value of the records of tank experiments published by Messrs. Froude, Denny, Baker, Taylor, Luke and others, for he knows how essential such records are for dealing with the cases of high-speed ships or for any variations from normal form and proportions; but he submits that for the normal class of vessel, the fact that the model is not self-propelled tends to obscure some of the factors concerned, and there is reason to think that the omitted factors, such as the effect of weather conditions and the effect of shape of stern lines on propeller efficiency, are of considerable relative importance in vessels of moderate speed and relatively low power. Tank experiments might enable effective horse-power to be estimated with considerable accuracy, but they leave the ratio $\frac{\text{effective horse-power}}{\text{indicated horse-power}}$ still to be selected from the results of trial trips and, as that ratio may vary, according to Sir A. Denny, from as low as 35 per cent. to as high as 65 per cent., and usually does vary between 47 per cent. and 53 per cent., the naval architect has still to use his judgment in the selecting. Mr. De Rusett prefers to use the direct method, which covers all the factors involved. After all, the trial trip data must be as fair a criterion of accuracy, especially when supplemented and amplified by subsequent records of the ship's performance at sea. The formula,

$$\text{Block coefficient} = 1{\cdot}304 - \frac{4\,V}{5\,\sqrt{L}}$$

given by Prof. Welch seems to the author to give too high a coefficient at low speeds and too low a coefficient at high speeds, but at values $\frac{V}{\sqrt{L}} = 0{\cdot}8$ it agrees very closely with the formula given in the paper.

Mr. Neill's table of comparative values shows that his formula

$$\text{Speed} = \frac{326 \sqrt{L}}{\text{block coefficient} - \cdot 19}$$

would tend to unnecessary fineness of model, except in the case of low speeds, and, here again, general practice seems to confirm the author's formula. The latter, in its present form, was devised by Mr. F. H. Alexander and given to the author some 10 or 12 years ago. He thanks Mr. Alexander for its utility. He has not tested the formula from the Admiralty type of vessels, but has done so for cruiser-stern high-speed passenger vessels. It has been suggested that the coefficient in the formula

$$1 \cdot 060 - \frac{V}{2 \sqrt{L}}$$

is fuller than is desirable. He does not think so, as it has not shown itself so in his experience.

Mr. Cannon and other speakers placed some stress upon making corrections for variations of length to beam and other proportions. The author has made allowance for differences in length. If the selected basis vessels are similar in other respects, such corrections are usually negligible.

As to Mr. Alexander's remarks respecting the adjustment of the Admiralty coefficient, the author thinks with him that it would probably be an improvement if a graphic method were devised whereby a more equitable adjustment could be made than by taking a mean of the values. In passing, he might state that he considers that the form of the afterbody lines has much more effect upon propeller efficiency than is usually taken into account. Again, in twin-screw vessels, the shape as well as the angle of the shaft bossing has, he feels sure, an effect upon the wake and thrust deduction values. So far as he has seen, the published experimental work on these points is meagre, although, of course, the very valuable papers by Mr. W. J. Luke, read before the Institute of Naval Architects, have dealt with the effect of coefficient of fineness and the angle of bossing. They have not, however, covered changes in actual shape of lines in hull and bossing leading to the propellers. Further experiments are needed on these points. His experience suggests the advisability of keeping the flow of water to the propeller as horizontal as possible and of tapering the shaft brackets on the underside only, instead of both above and below as is often done, and of laying off the upper surface of the bossings at right angles to the mean line of the moulded edge of the frames from whence they project. The table referred to by Mr. Brown should be very useful for reference when looking up Mr. Baker's investigations on the effect of changes of form. His suggestion of check estimates of indicated horse-power by independent methods is usually followed in cases of special difficulty.

Mr. Buchanan asked why a larger margin for contingencies had been allowed in the case of trials on the Skelmorlie mile than in those on the Whitley mile. The reverse is actually the case. The author has allowed 2 per cent. more power for a vessel to be tried on the Whitley mile than off Skelmorlie, the reason being that the Scottish course is well sheltered from weather and has deep water. This means that higher Admiralty coefficients will generally be obtained on trial there than off Whitley; hence, when using the Admiralty coefficients obtained on the Skelmorlie mile as a basis for estimating for a ship to be tried off Whitley, the inference is that more power must be provided for the latter course. The 2 per cent. is the author's estimate. It would be helpful to have data of trial results of vessels which have had load trials at each of these measured miles.

Mr. De Rusett is not clear what Mr. Lovett means by the expression "actual horse-powers derived from tank experiments." If he means horse-powers obtained by taking twice the effective horse-power calculated from the model experiments, then it is, perhaps, hardly correct to use the word "actual." It has already been pointed out that the ratio $\frac{\text{effective horse-power}}{\text{indicated horse-power}}$ is not a constant. It can vary sufficiently to cover the apparent errors given in the first two of Mr. Lovett's examples. In this third example, the difference is, no doubt, considerable, but, without knowing the particulars of the ships and their performances more closely, it is not easy to show why the difference is so great as stated.

It is to be remembered that, in using the system dealt with in the paper, the basis vessels will, in most cases, be those for which full data, including shape of lines, are known to the estimator. In using basis vessels built by other firms or for which the information is insufficiently complete, the estimator will have to allow for what, in his opinion, may be faults of design in these vessels and, also, for possible adverse or favourable conditions of trial. It is quite possible that certain firms have greater success in propulsion than others, solely because of certain features peculiar to their own ships, which features are not approved of or are treated merely as matters of opinion by others. It appears that the author had not made himself quite clear as to the use which should be made of Table C, but, in the comments which followed the table in the paper, he called attention to the fact that there would be cases where the percentage changes in Admiralty constant were greater than one-third the percentage changes in block coefficient and it was to be understood that the position of the vessels concerned should be considered in relation to those given in the table and, at the higher speed-length ratios, the gain through fining was much stronger, and this, of course, must be borne in mind.

FROM OUR CORRESPONDENTS.

CLYDE AND DISTRICT.

(FROM OUR OWN CORRESPONDENT.)

Glasgow.

After a period of unexampled activity the Scottish steel works, as well as the shipyards and engineering establishments, are closed this week for holidays. In the case of the steel works the holiday period is one of considerable importance, as advantage is taken of the stoppage to effect renewals and repairs. It is stated that owing to the extraordinary demands made on the steel-making plants throughout the country, the repairs this year are exceptionally heavy. The pressure for the delivery of steel, which is now entirely on Government account, either directly or indirectly, continues very great, and every effort is being made to secure maximum outputs. In the Glasgow district work will be resumed, nominally at least, on Monday, but a few days will probably elapse before industrial affairs resume their normal aspect. On the lower reaches of the Clyde, where the holidays are earlier than in Glasgow, the shipyards and engineering works were re-opened at the beginning of the present week.

TRAINING BOYS FOR MERCANTILE MARINE.

An appeal for additional funds to carry on the work of the Clyde training ship *Empress* has just been issued by the Executive Committee of that Institution. The signatories to the appeal are all more or less well known in shipping circles. They are Lord Inverclyde, president; Lord Graham, vice-president; Mr. J. A. Black, chairman; and Mr. J. R. Harrison, vice-chairman. A sum of £12,000 is asked for in order that the cost of improvements and alterations on the training ship may be defrayed, and that the work may be more efficiently carried on in future. This work is of more than ordinary interest to Clyde shipowners. During the past 10 years, it is stated that 60 per cent. of the boys trained on board the *Empress* have gone to sea, a few of them to the navy, but the majority into the mercantile marine. Since the Institution was founded in 1869, the number of boys who have passed through the ship is 5,717. Of the £12,000 required to put the work on a satisfactory basis a sum of £7,500 has already been subscribed.

THE MID-SCOTLAND SHIP CANAL.

The project to construct a Mid-Scotland Ship Canal continues to absorb a great deal of the attention of public bodies as well as of private individuals who are interesting themselves in the proposal. The matter was again before a meeting of the Glasgow Chamber of Commerce last week, when a report on the subject by a committee was submitted to the Chamber. The report was to the effect that in the event of the Government deciding to construct the canal the directors of the Chamber should urge that full consideration be given to the direct route, but they also expressed the opinion that such a canal would not attract sufficient commercial traffic to make it remunerative. Mr. F. C. Gardiner, in referring to the matter, said that for his part he hesitated to believe that at the present moment the Government contemplated an expenditure of about £40,000,000 on this canal and embarking on such a measure without placing the proposal before the country and certainly before the House of Commons.

THE HOUSING OF CLYDE WORKERS.

One of the most serious problems awaiting solution in the Clyde district at present is the shortage of housing accommodation for the working classes. The expansion of the shipbuilding and allied

industries, as well as the making of munitions, has brought to the district many thousands of skilled, as well as unskilled, workers, who have had great difficulty in securing suitable dwellings. The high cost of material, and other conditions arising out of the war, have prevented private enterprise from meeting the demand. The request for houses has, however, become so urgent that the authorities have instituted enquiries into the matter with a view to taking action. An important conference was held on the subject in Glasgow recently, and this week the Secretary for Scotland has agreed to receive at the Scottish office in London a deputation from various local authorities in the Clyde area and from district trades councils in and around Glasgow. At Clydebank and Dalmuir, where, in the vicinity of the great shipyards, the problem is very acute, the Local Government Board propose to erect 100 cottages, as the first instalment of a scheme for the solution of the problem. An interesting feature of the scheme is that the Board have suggested that the cottages, when erected, might be taken over by the Clydebank Town Council, at terms to be mutually arranged.

NORTH-EAST COAST.

(From Our Own Correspondent.)

Newcastle-on-Tyne.

A little over two years ago a working agreement was proposed between the Boilermakers and the Shipwrights' Societies, but it did not materialise because of the uncertain vote of the latter union. The members of the Boilermakers' Society, however, endorsed the scheme by a large majority. A revival of interest in the proposal has recently taken place in consequence of another meeting between the executives of the two Societies, and the outcome of this is that the shipwrights' Executive have decided to again submit the question to the members with a strong recommendation for acceptance. If there is a favourable vote this time, it is the intention of the Boilermakers to lose no time in co-operating with the Shipwrights with the view of putting the agreement into operation.

Labour Troubles after the War.

It will be interesting to watch, after the war is over, how far State interference in labour troubles is desired to be continued by the combinations of employers on the one hand and the trade unions on the other. There has been a good deal of it since the great European conflict began, and the advantages and disadvantages are being weighed in the balance, but the conditions are so abnormal that it is almost impossible for the time being to adjust industrial problems to their right perspective. Mr. John Hill, General Secretary of the Boilermakers' Society, remarks, in his latest report, that he does not want a continuance of the compulsory arbitration, nor of the "ticket-of-leave" system, but he hopes the State machinery for judging the merits of all questions of difference before actual stoppages take place will be retained. It is only by the establishment and experience of such machinery, he says, that confidence will be restored and industrial war brought to an end. Any machinery, we should say, that puts an effective check upon strikes will be welcomed when ordinary conditions of industry are resumed. Previous to the war, sectional stoppages of work were a source of great irritation to both employers and trade unions alike, and the costliness of them was brought home in many ways. Since the war the great majority of unions have accumulated large reserves, mainly because their strike outlay has been so small in the interval, and they now clearly see how financially strong they could become if there were freedom from the draining which frequent strikes involve.

Tyne Dock and River Dues.

When the increase of 33⅓ per cent. in the Tyne Dock and River Dues came into operation on July 1, it was understood that the Finance Committee of the Tyne Improvement Commission would consider if the additional charges had to be general or whether certain exceptions could be made in some cases where increases had previously been made, but at the last meeting of the authority, Mr. Arthur Scholefield announced that the committee had gone carefully into the matter and had decided that the new rates would be levied uniformly. The Tyne Commission, like many another similar authority, is likely to be faced with a deficit at the end of the current year, in consequence of the diminished volume of trade, and it is therefore looking well ahead in the matter of trying to raise as much revenue as possible. Mr. Everett thought some concession might have been made in respect of the higher dues charged for the opening of the swing bridge at Newcastle, suggesting that the additional rate might have the effect of diverting trade from the upper reaches of the river, but Mr. Scholefield pointed out that if the Commission commenced to give way, say in the bridge instance, there would be other interests coming forward to prove that they also were sufferers. The increased burden will therefore apply all round. It may be added that the shipowners as a body did not raise any objection to increased bridge toll.

Welfare of Apprentices.

One of the gratifying signs of the times is the closer and more sympathetic attention which is being devoted to the welfare and progress of the apprentice. It is coming to be generally recognised that the better training a youth receives, the better artisan is he likely to be in the long run. There has just been a notable conference at Gateshead, between representatives of the leading engineering firms in the district, secretaries and inspectors and head masters and teachers, the subject under discussion being the more efficient training and education of apprentices to the engineering trades. Among numerous points upon which general agreement was arrived at were the recommendations that in each factory there should be welfare supervisors, who should, after consultation with employers, select youths for advancement, and should do all in their power to look after the apprentices, guiding their studies, recreations, and training, and that technical and continuation classes should be formed and opportunities given to youths to attend during the day by release from work.

Reform of Commercial Education.

Since the war commenced it has become a platitude to say that commercial education in this country is badly in want of a reforming stimulus if we are to retain and expand British trade abroad. Newcastle, through its scholastic institutions and its Chamber of Commerce, has been working hard on progressive lines in the past two years to thoroughly awaken public interest in this subject. At the last meeting of the local Rotary Club, which is composed entirely of business men, Dr. W. H. Hadow, the Principal of Armstrong College, gave a rousing address on commercial education, in the course of which he advocated co-operation between the academic and the business elements in the training of young men, the need there was for capable agents to push British trade in all parts of the world, and the urgency of reforming the British Consular service. Investigations of the last year or two have shown that in the latter there was great scope for improvement, and it is worth mentioning that Dr. Hadow himself has prepared a scheme for putting the Consular service abroad on well-organised and effective lines, and it is now being considered in the right quarters.

MERSEY SHIPPING AND SHIPBUILDING.

(From Our Own Correspondent.)

Liverpool.

Although the Liverpool dockers were given an increase in wages of roughly speaking 7s. a week as recently as March last, they have just put forward another demand for 2s. a week increase. If this is granted they will have succeeded in nearly doubling their pay, when compared with the pre-war rates. The annoying part of it is that these repeated demands for increases have a disturbing effect upon the working of the port, and presumably it will necessitate another advance being made in the Master Porters' rates.

Marine Engineers' Wages.

The marine engineers at this port are agitating for higher wages and improved conditions, and a meeting of the local branch of the Marine Engineers' Association has just been held, and decided upon the procedure to attain these ends. It is being urged that the members of the profession are doing their share in assisting the country in the present crisis, but that those serving in the armed cruisers, mine sweepers and patrol steamers are not receiving due recognition by the Admiralty. The hope is entertained that two of the principal liner companies in Liverpool having recently given substantial increases to some of their senior engineers, other companies will follow their example.

Liverpool Chamber of Commerce.

The war has given a fillip to the activities of the Liverpool Chamber of Commerce, and as was stated at the 67th annual meeting held on Thursday, the Chamber is expanding both in its membership and the trade sections into which it is divided. The former has increased

during the past year by 368, and three new sections have been added, one of which, the South American section, promises some interesting trade developments to shipping after the war. Another new section for the engineering trades is at the present time well advanced in formation.

The principal feature of the speeches was the references made to the centralisation of business interests in London, and on this subject the Hon. F. M. B. Fisher, ex-Minister of Trade and Marine, New Zealand, expressed the opinion, that the Chamber was right in their attitude in scenting danger from it. London, he said, was already overburdened and over-clogged, and so busy that it was unable to do the business it already had. The Liverpool Chamber of Commerce could best serve the interests of the country by preserving their independence, and preserving their driving force for moving London when London wanted moving.

Captive Merchant Service Officers.

The Imperial Merchant Service Guild have been able to obtain from the Foreign Office the interesting information that British delegates at The Hague have been assured by the German representatives that captains and officers of British merchant ships, who have been taken captive by enemy submarines and raiders and relegated from officers' camps to ordinary internment camps are to be returned to officers' camps both in Germany and Austria. It is understood that the Board of Trade will make the necessary financial provision, the lack of which was the cause of their removal.

SOUTH WALES NOTES.

(From Our Own Correspondent.)

Cardiff.

In the July report of the Amalgamated Society of Engineers the following appears as part of the report of the Cardiff district delegate: "Trade in marine yards is slightly better than a month ago, and fitters are wanted at Pembroke Dockyard. A matter of demarcation at Chepstow Shipyard has had attention, and now the matter is put right, our members ought to remember it is their duty to maintain the trade right they possess as guardians of an unbroken record not to be frittered away by carelessness and indifference. A conference of representatives from the Bristol Channel ports has been held, when it was decided to make application for 100 per cent. increase on July rates, 1917, for foreman journeymen and apprentices. Matter arising out of demarcation of work, payment of apprentices and proper rate on oil steamers have had attention."

Cardiff Docks Coal Washery.

One of the finest coal washeries in the United Kingdom is situated between the Roath & Queen Alexandra Docks, Cardiff. It was originally constructed for the washing of small coals bought for export to Italy, but for some considerable time it has lain idle. It is understood that negotiations are in progress which may result in the re-starting of the works under the control of the British Admiralty authorities. The re-opening will relieve the small coal congestion, and also provide an increased supply of washed coal for Admiralty purposes.

Swansea's Future Trade.

Sir Griffith Thomas, presiding at a meeting of the Swansea Harbour Trust, said a party of gentlemen, associated with great enterprises, who had recently visited the port, were much impressed with Swansea's dock facilities and had expressed their approval of both import and export arrangements. He said there would shortly be a great improvement in the trade of the port. The negotiations with the Persian Oil Company were being carried to a satisfactory conclusion, and he hoped the Harbour Trust would be receiving rent from the company in the New Year. He understood from one of the leading men of the company that the Trust would be receiving oil in large quantities next year.

The attempt which is now being made to make Swansea a depôt and a distributing centre for imported oil is of considerable interest. Seven or eight years ago Cardiff had a considerable share of the import of oil into the Bristol Channel, but in recent years that trade has been almost entirely lost, and at present Bristol enjoys practically a monopoly in this respect.

Newport an Imperial Port.

At a meeting of the Newport Harbour Commissioners, Mr. F. J. Robjent raised the question of Newport being recognised as an Imperial port. He pointed out the natural facilities of the port for the quick transport of coal and other goods and to the progressive policy of the Alexandra Docks Company, who had made their undertaking one of the best in the country. He said there was a great future for the port.

Action Over Seaman's Advance Note.

His Honour Judge Hill Kelly, at the Cardiff County Court, dealt with an action brought by Mr. J. D. Butler against the Penarc Steamship Company, Ltd., to recover £4 5s. under an advance note. The facts, which were admitted, were that Wm. Hill, who shipped as second cook, was given an advance note and a ticket to Avonmouth, but on attending on board the vessel he refused to join, did not sign articles, and did not sail. Hill transferred the advance note to Mr. Butler. On behalf of the plaintiff it was contended that the advance note was in an unusual form, inasmuch as it set out that Hill had signed on as second cook, whereas he had not, in fact, signed articles, and the plaintiff was thereby misled. For the defendants it was admitted that the advance note was not negotiable, and that Hill not having proceeded in the ship the condition upon which the note had been given had not been complied with and the transferee could not recover. His Honour gave judgment for the defendants with costs.

BELFAST SHIPBUILDING AND SHIPPING.

(From Our Own Correspondent.)

Belfast.

The yards are closed down at present for the annual holiday, and are not due to re-open till Monday, July 23. They knocked off on the evening of July 11, so that the present holiday is the longest since the war began. The application of the men for an advance of 10s., and 5s. for youths, which was sent in some time ago, was before the Committee on Production in London last week, and the award is expected in a few days. There is nothing publishable to report from the yards, which will resume with an abundance of work never equalled in the history of the port, the number of orders on hand and to be commenced being exceptionally large. Renewals and repairs are being carried out extensively during the holidays.

Shipbuilding in Londonderry.

Developments in connection with the extension of the premises of the North of Ireland Shipbuilding Company in Londonderry are now in progress. The Harbour engineer has completed the removal of the portion of the fishery wharf authorised by the Board in April, 1917, in connection with which new slipways are being laid down by the shipbuilding company. The removal of the balance of the wharf will be commenced as soon as the engineer has completed certain other work and has the necessary men available. It has been decided to lay down an electric cable conduit along the quay from the electric station to the shipyard.

THE FREIGHT MARKETS.

(From Our Own Correspondents.)

London.

Though chartering continues slow on the Baltic Exchange, rates are, in consequence of the restricted number of vessels available, maintained firmly and remain high. From the Northern Range especially the inquiry is keen, while the Eastern section of the market is ready to absorb all available tonnage. From the River Plate figures are unchanged, and 145s. from the upper ports and 5s. less for down river loading continues to be quoted. The North American Atlantic seaboard ports are asking for vessels on net form of charter, for which up to 200s. is offered from the Northern Range to the United Kingdom or 20s. more to the French Mediterranean ports. To West Italy 325s. can be had. An additional 30s. would be paid for Gulf loading. For heavy grain no more than 30s. is quoted from the Range to the United Kingdom, and oats would come at 25s. Virginia coal charterers are willing to pay 125s. to the River Plate and $30 to Rio de Janeiro, but tonnage is not forthcoming at these figures. Good rates can be had for sugar cargoes from Cuba to France and Italy. The requirements of the East remain unsatisfied, though full rates continue to be named. Thus Karachi would pay 250s. on scale basis to the United Kingdom, Bombay on deadweight offers 320s. to the United Kingdom and up to 450s. to the Mediterranean, and from the Madras Coast kernels

command fully 500s. to Marseilles. The rice ports are badly in need of boats, for which Burmah offers 480s. to the United Kingdom and Saigon 500s. to France. In the Mediterranean section of the market Alexandria offers no more than 105s., and probably 100s. is nearer the value to the United Kingdom. Salt business offers 50s. Torrerieja to Calcutta. The ore and phosphate ports are taking up tonnage steadily, this class of business being on the basis of 45s. Huelva to the Mersey; 50s. Bougie to the Clyde; and 65s. Tunis to the same destination. Bay business is being done at 22s. 6d. Bayonne, and 20s. Bordeaux to the Bristol Channel. An active inquiry exists for neutral steamers on time charter at full rates.

Glasgow.

The holidays have to some extent interfered with business on the Glasgow market, but apart from that, the condition of affairs has been extremely quiet for some time. There has been little change apparent in the outward market, and rates have continued firm. The export coal trade has shrunk to comparatively small dimensions in view of the holidays, but the moderate amount of tonnage available was not sufficient to meet the demand. Chartering outwards was confined mainly to tonnage under requisition, and a transaction was reported for Gibraltar towards the end of the week. In homeward markets business was almost at a standstill and quotations were only nominal in value. Rates were quoted at full figures, but the results were disappointing. From the States grain was indicated at about 30s. per quarter to the United Kingdom or French Atlantic, and net charter about 220s. No change was reported in Eastern markets.

Newcastle-on-Tyne.

The shortage of collier tonnage on offer in the local freight market was even more pronounced than usual during most of last week, a fact which had a reflex action on the local collieries and rendered the continuity of regular employment of these exceedingly difficult—in fact, impossible in some instances—with the result that much short-time working was reported from the two counties. The present week opened with a much-improved tonnage supply, however, and consequently, although very many more vessels are needed in order to ensure full employment for the local coal producers, chartering has been comparatively brisk. As usual, most of the fixtures reported are for French Atlantic ports with coal and/or coke cargoes. Coasting business has been done at the improved rate of 16s. Gibraltar has been arranged for at 85s. for a 1,400-ton steamer. Valencia has been fixed for a 4,000-tonner at 175s. Portuguese ports are quoted at 85s. for Lisbon and 95s. for Oporto. Port Said stands at 150s. Gothenburg has been twice fixed for at the very high rate of 190 kr.

Liverpool.

There is no change in the outward freight position, and if anything boats are more difficult to obtain, especially at the coal ports. Outward chartering is subject to the same conditions, but a neutral boat of 3,500 tons d.w. has been secured, Mersey to Lisbon, at 90s. July. Time chartering quiet on very few offers, but neutrals can get full figures for suitable boats. Homeward freights are firm all round, and most markets are eager to secure tonnage. Eastern ports are unable to attract ships at the best offers which indicate 500s. from Madras to Marseilles, and a like figure would be paid for rice Saigon to France. Bombay also indicates 320s. on d.w. to United Kingdom. Mediterranean ore ports are paying full recent rates for tonnage that can be secured. North America maintains a good tone, and net charters are very firm. A 4,500-ton boat has been fixed New York to Liverpool at 200s. net, July-August, while 220s. is still quoted to France, and 330s. to Italy. Grain is quiet on basis of 30s. to United Kingdom, and 35s. Gulf to Italy. Nitrate ports have fixed a 8,000-ton d.w. boat to Italy at about 220s. August-September. River Plate homewards unchanged at 145s. from up-river ports to United Kingdom.

Cardiff and Swansea.

Outward coal chartering continues quiet, tonnage still being short of the demand. There is a large enquiry for ports outside the limitation ports and exceedingly high rates are being demanded. The number of fixtures reported for French ports is smaller than usual—Caen 47s. 6d. (neutral); Dieppe, 24s. 6d. (Allied); and Rouen, 74s. 3d. (neutral) for a cargo of coke. Four small sailing craft, which are not subject to the limitation scheme, were fixed at 120s. for several voyages, two for Honfleur and one each for Caen and Cherbourg. There is a large demand for Spanish ports at high rates, Newport to Bilbao was fixed at 120s., while Barcelona paid the extremely high figure of 220s., this being an advance of 40s. on the last rate paid. On the Swansea market conditions remain generally without alteration, tonnage still being in short supply. The only fixtures reported were Dublin at 18s. and Caen, 48s. (neutral).

Hull.

The market remains very firm in tone with a strong demand for North French destinations. There is a fairly active trade for France and Italy, but tonnage is scarce. The neutral markets continue to be full of inquiry, but the difficulty of securing tonnage and permits prevents more than a limited chartering business.

The coal export trade of the Humber has suffered a severe loss by the death of Mr. James Turner, aged 37, of the Hull office of D. M. Stevenson & Co., coal exporters, who died suddenly at Edinburgh. Deceased was returning from Scotland from the deathbed of his mother when he had a heart attack which proved fatal. Mr. Turner was the Vice-Chairman of the Humber Coal Exporters' Association and Chairman of the Humber Committee for the Supply of Coal to France and Italy. He was a co-opted member of the Council of the Hull Chamber of Shipping.

COMPANY MEETINGS.

The "Shell" Transport & Trading Company, Ltd.—The annual meeting was held on July 12. The Chairman (Sir Marcus Samuel, Bart.), in moving the adoption of the report, said that practically the whole of their tonnage had been engaged in the service of the Allies, and, to replace the boats commandeered at Blue-Book rates, they had been compelled to charter neutral tonnage at enormous rates. As a consequence, the cost of distribution of their products had increased considerably, whilst they had not raised their rates of freight to those companies for which they had contracted to carry oil. Among the many sacrifices they had been called upon to make in the national interests, none had distressed them so much as having to abandon temporarily the "Shell" trade mark, which stood as the hall mark of excellence in petrol. Although it had been necessary to suppress that temporarily, they had many indications of the joy with which motorists would welcome it when the obligation to surrender it for national purposes was removed and they could again put it on the market for general use through the "Shell" Marketing Company, Ltd., which had been distributing their products since January 1 of this year. He had not given full details of their production because it was misleading, seeing that it was restricted by the fact that they were unable to obtain transport, and, consequently, were unable to produce to the full extent of their territories. This he was convinced of—that they would prove that they were able to produce considerably more from all the territories in which they operated when they could obtain the necessary facilities for handling it. Experience had proved how great a part petroleum will play in the future of the world's history. They were most fortunate in having their supplies so widely distributed and of such varied qualities that they were in a position to take full advantage of any extended demands. Oil was actually being taken to-day from San Francisco to Calcutta by tank steamers, which passed their refinery a few days before reaching their destination, and the oil was being sold there at a price which was lower than that realised for the same oil in San Francisco itself. To prove how useless this competition (involving as it did an enormous waste of tonnage, which could be much better used to further the interests of the Allies by bringing petrol here), he might mention that they actually held 30,000,000 gallons of petrol ready for shipment at their Eastern refineries. No one in this country needed instruction to realise what it would mean if it could be brought here by the tonnage which was being so wantonly wasted by the Standard Oil Company. He was glad to see that in the new coal distribution scheme (which follows exactly the same principle as he had been describing in regard to their own organisation—that is, the full utilisation of geographical position) hundreds of millions of ton-miles were to be saved. That would bring home what their geographical position really meant to them, and why it was it made them unassailable in the markets which they naturally served, and why it helped to give them confidence that their profits in the future would certainly not be less than they had been in the past. Several of their competitors tried years before them to find oil in Egypt in paying quantities. They succeeded where the others failed, because of their scientific methods, their financial strength and perseverance, and in spite of persistent ill-luck.

Mr. H. W. A. Deterding seconded the resolution, which was carried.

COMPANY REPORTS AND DIVIDENDS.

Cairn Line.—Half-yearly dividend (including the 2½ per cent. interim payment) at the rate of 10 per cent. per annum, free of tax, and bonus of 6d. per share.

Furness, Withy & Co., Ltd.—The directors announce that warrants for dividend on ordinary shares of 10 per cent. per annum for quarter ending July 31, being 6d. per share, free of income-tax, will be posted on that date to all shareholders registered on July 14.

Mercantile Steamship Company, Ltd.—The directors have decided to pay an interim dividend of 7s. 6d. per share, being at the rate of 15 per cent. per annum on the ordinary shares, and the interest of 2½ per cent. for the half-year on the preference shares, both to be paid on August 4.

Rhine u. Seeschiffahrt Gesell., Köln.—The gross profit for the year 1916 amounted to £69,500 (£67,000). Including £1,675 (£1,410) brought forward, the net profit is £6,900 (£1,675), and £1,640 is carried to new account. The quantity of coal and coke carried during the year showed an increase of 45 per cent., but the coal freights were too low and actually showed a loss during the second six months. The Mannheimer Dampfschleppschiffahrt Gesell. belongs to the above concern and realised a gross profit of £25,000 (£30,400) and a net profit of £2,140 (£1,075), all of which is brought to current account. The Mannheimer Lagerhausgesellschaft, also belonging to the same firm, realised £46,900 (£63,500) gross profit and £2,360 (£940) net profit (all brought to current account).

The W. & C. T. Jones Steamship Company, Ltd.—The preparation of the accounts and publication of the balance sheet for the year ending June 30, 1917, will be unavoidably delayed. In the meantime it has been decided to pay a final dividend of 2s. per share, free of income-tax, making 20 per cent. for the year. The profits and dividends for the last five years are as follows :—

Year ended June	Profits. £	Dividend. Per cent.
1913	105,268	10
1914	51,718	5
1915	90,875	10
1916	204,885*	25
1917	—	20

* After reserving £320,000 for excess profits tax, &c.

Ebbw Vale Steel, Iron & Coal Company, Ltd.—The annual report for the year ended March 31 last states that the whole of the operations of the company are now controlled by the Government. The gross profits for the year (after provision for estimated liability for income-tax, excess profits duty and depreciation) amount to £299,489, which, with the balance brought forward, makes a total of £328,716. Deducting general and legal expenses, interest on debentures and special loans, &c., there is an available balance of £228,499. From this has to be deducted expenditure on preference shares already paid £12,000, leaving £202,721. The directors propose to apply this in payment of a final dividend on the preference shares, making 6 per cent. for the year; to reserve, £50,000; and recommend a dividend on the ordinary shares of 15 per cent. for the year, leaving £13,221 to be carried forward.

Nippon Yusen Kaisha.—The report of the directors for the half-year to March 31, states that the surplus of earnings, after deducting current expenditure, amount to 22,155,245 yen, out of which there has been deducted for depreciation of the fleet and property, 1,443,457 yen; insurance fund, 844,301 yen; ships' structural repair fund, 350,352 yen; leaving a balance of 38,478,290 yen, including 18,961,156 yen brought forward. The directors propose that 975,856 yen be added to reserve fund, and that 200,000 yen be allowed as directors' and auditors' fees, and 400,000 yen for the employees as special war grant. From the remainder the directors recommend a dividend of 8 per cent. per annum, besides 2 per cent. per annum as special dividend and a further 20 per cent. per annum as extra special dividend. The total of the dividends will absorb 4,125,000 yen, leaving a balance of 32,777,433 yen. For the adjustment of this balance the directors propose to apportion to special reserve for war risk and depreciation of value of vessels to be built and purchased, 13,500,000 yen; special depreciation of book value of fleet, 3,000,000 yen; special reserve, 5,500,000 yen; fund for training, protection and encouragement of seamen, 500,000 yen; dividend equalisation fund, 3,270,000 yen; extra special dividend (40 per cent. per annum), 5,500,000 yen; directors' and auditors' extra allowance, 150,000 yen; extra bonus for employees, 825,000 yen; final balance to be carried forward, 532,433 yen.

COMPANY REGISTRATIONS.

Atwell Foundries, Ltd.—Capital, £5,000, in £1 shares. Objects, iron, aluminium, copper, tin, bronze, brass and steel founders and casters, boilermakers, wire drawers, iron, copper and steel cable manufacturers, electricians, &c. Signatories :—

L. B. Sollas Dawnside, The Drive, Beckenham, Surrey, shipowner.
S. W. Oakley, Bracknell, Berks., shipowner.

The first directors are E. H. Sollas and S. W. Oakley. Registered office, 52, Gracechurch Street, E.C. Private company.

Reginald Christie & Dickinson, Ltd.—Capital, £1,000, in £1 shares. Objects, to take over the business of a marine engineer, engineers' agent, &c., formerly carried on by R. Christie at 5, Lloyd's Avenue, E.C., as "Reginald Christie & Co.," also to carry on the business of consulting and electrical engineers, &c. Signatories :—

R. Christie, 1911, High Street, Marylebone, W. 1, engineer.
J. T. Dickinson, 18, Greenbrook Road, Lytham, S.E., engineer.

The first directors are R. Christie and J. T. Dickinson. Solicitors, Nash, Field & Co., 12, Queen Street, E.C. Private company.

E. Storey & Co., Ltd.—Capital, £36,000, in £1 shares (35,900 6 per cent. cumulative preference and 100 ordinary). Objects, to take over the business of coal merchants, colliery agents, forwarding agents, &c., carried on as "E. Storey & Co.," also to carry on the business of importers, exporters, ironmasters, &c. Agreement with J. H. Eccles. Signatories :—

J. H. Eccles, 34, Castle Street, Liverpool, colliery agent.
J. Rigby, 34, Castle Street, Liverpool, manager.
D. E. Ainsworth, 34, Castle Street, Liverpool, sub-manager and secretary.

The first directors are J. H. Eccles (permanent governing director), J. Rigby and D. E. Ainsworth. Registered office, 34, Castle Street, Liverpool. Private company.

Glenford & Co., Ltd.—Capital, £17,000, in £1 shares. Objects, to acquire the ship *Celtic Glen*. Signatories :—

H. C. Chambers, Kern, Blakesley Road, Yardley, Birmingham, solicitor's managing clerk.
C. J. Withington, 29, Bowyer Road, Saltley, Birmingham, accountant.

The first directors are to be appointed by the subscribers. Solicitors, Pinsent & Co., 6, Bennetts Hill, Birmingham. Private company.

Pyman Bros. (1917), Ltd.—Capital, £50,000, in £1 shares (with power to divide into classes). Objects, shipowners, brokers and builders, ships' husbands, insurance brokers, underwriters, &c. Signatories :—

F. H. Pyman, 57, Bishopsgate, E.C., shipowner.
G. N. Ryan, 57, Bishopsgate E.C., shipowner.
W. H. S. Pyman, Raithwaite House, Whitby, Yorks., gentleman.

The first directors are F. H. Pyman (permanent, special qualification, 1,000 ordinary shares), G. N. Ryan, W. H. S. Pyman and W. H. Pyman. Qualification of ordinary directors, 500 ordinary shares. Remuneration (except any managing director), £100 each per annum. In addition to general borrowing powers, the directors are expressly authorised to create £250 special debentures, secured solely by the company's covenant and not charged on all or part of the undertaking or property. These debentures will receive in lieu of interest, one two-hundred-and-fiftieth part of one-third of the amount of the dividend or bonus on the ordinary shares. Registered office, 57, Bishopsgate, E.C. Private company.

Sutcliffe & Co., Ltd.—Capital £15,000, in £10 shares. Objects, to take over the business of a shipowner, shipbroker, shipping agent, coal merchant, insurance broker, &c., carried on by J. B. Sutcliffe, at Boston or elsewhere, as "Sutcliffe & Co." Signatories :

J. B. Sutcliffe, 32, Market Place, Boston, Lincs., shipbroker,
Mrs. E. Sutcliffe, Market Place, Boston, Lincs.

The first directors are J. B. Sutcliffe (permanent governing director) and Mrs. E. Sutcliffe. Qualification: £100. Solicitor, B. F. Rice, Boston, Lincs. Private company.

Egis Shipyard, Ltd.—Capital £100,000, in £1 shares. Objects, shipbuilders, shipwrights, dock constructors and owners, barge owners, wharfingers, &c. Signatories :—

W. Graham, 24, Coleman Street, E.C., solicitor.
W. L. Waite, 25, Wallingford Avenue, North Kensington, W., clerk.

The first directors are to be appointed by the subscribers. Solicitors, Nicholson, Graham & Jones, 24, Coleman Street, E.C. Private company.

NEWS PARAGRAPHS.

Standard Ships.—It is stated on behalf of the Shipping Controller that the first standard ship of the Government programme will come into service about the end of this month. Her gross register tonnage will be approximately 5,000 tons.

Australian Shipbuilding Programme.—Mr. Hughes, Prime Minister of Australia, announces that the trade unions concerned have accepted the Government's proposals in regard to the shipbuilding programme. An agreement on the question of dilution of labour is expected shortly.

Fire at Newport Dry Docks.—Damage estimated at between £5,000 and £6,000 was caused by an outbreak of fire at Newport, Mon., on Saturday. It appears to have been started in a garage of Mordey, Carney & Co., and spread to the offices and joiners' and shipwrights' workshops. A part of the premises of the Channel Dry Docks Company, including the shipwrights' shop, full of newly-made work, was also involved.

Purchasing Ships' Stores Abroad.—The following Board of Trade announcement has been issued through the Press Bureau :—A number of shipowners have already arranged to purchase ships' stores and provisions at ports abroad, so as to avoid drawing on stocks at home. The three departments concerned—the Ministry of Food, Ministry of Shipping, and Board of Trade—request that all shipowners will follow this example, and forthwith give instructions that stores and provisions are always to be purchased at ports abroad when it is at all practicable.

Awards by H.M. the King of Norway.—The Board of Trade have received through the Norwegian Consul-General, a silver cup, which has been awarded by His Majesty the King of Norway to Capt. A. H. Perrin, Master of the steamship *Copsewood*, of Middlesbrough, and silver medals awarded to Mr. W. E. Wedgwood, first officer; Mr. C. Johansson, second officer; and W. Holmquist, H. Laursen, G. Atherfold and A. Ashby, seamen, of the *Copsewood*, in recognition of their services in rescuing the crew of the Norwegian barque *Lovspring*, of Sandefjord, on December 25, 1915.

Norwegian-Russian Steamship Line.—The Norwegian-Russian Steamship Line Company has been formed to operate a service between the Baltic and the Black Sea. The head office will be in Christiania, where Winje & Company will act as agents. A preliminary agreement has been signed with the Russian Steamship Company, of Petrograd, to operate a joint service between Russian Baltic ports, Christiania, Bergen, Antwerp, Rotterdam, London, and the Black Sea. At the start, each company is to provide two steamers, one of 3,300 tons d.w. and one of 8,800 tons d.w.

Mersey Docks and Harbour Board.—The annual abstract of accounts shows that the total net register tonnage of vessels paying dock tonnage dues or harbour dues amounted, for the 12 months ended July 1, to 14,018,652 tons, compared with 15,679,943 tons for the previous 12 months, a decrease of 1,661,291 tons. The number of vessels was 16,747, against 18,742, a decrease of 1,995. Government vessels are not included in the list. The figures given are those paying rates to the Board, either inwards or outwards, so that for the full movement it is necessary to double the totals. The rates received on vessels amounted to £759,377, against £738,817, an increase of £20,560, and the rates and dues received in goods amounted to £766,407, against £749,961, an increase of £16,466. The total increase in receipts is, therefore, £37,006.

Unissued Shares of Britain Steamship Company, Ltd.—This company has issued a circular to shareholders pointing out that of a nominal capital of £500,000, in £10 shares, the shares actually subscribed number 46,396, leaving 3,604 available to be issued. Of these 1,500 shares have been allotted in payment for the 16-64th shares in the s.s. *Highbury*, and there now remain 2,104 shares to complete the created capital. The directors now offer these *pro rata* to existing shareholders at £10 premium. The number of shares only admits of an allotment of one full share in respect to each holding of 23 shares, but in order that every shareholder may receive his full proportion of any benefit there may be in the issue it is proposed to sell such number of shares as under this arrangement remain unallotted, and to divide the proceeds rateably among such shareholders as may not be entitled to an allotment. If any shareholder wishes to make an offer at a higher price than £10 premium for any part of the shares which are for disposal in respect of the unallotted shares, such offer will be considered by the directors. The shares now offered will rank for dividend as from January 1 last.

Shipbuilding in Canada.—With sufficient work on hand to keep the shipyards busy till the end of navigation in 1918, the Port Arthur Shipbuilding Company is looking forward to a brisk season. They have under construction at the present time six boats of full canal size, each to be 261 ft. in length. Two of these boats are under contract for the Great Lakes Transportation Company, and the other four, of a similar type, are being built for the Port Arthur Shipbuilding Company, to their own order, and for their own disposal. There are 650 men working at the shipbuilding yards, but it is anticipated that 1,000 will be working later on.

Suffering in Boats.—Capt. D. H. Bernard (of the *Merchant Service Review*) has designed a case, hermetically sealed, 8 in. wide, containing a variety of concentrated foods of thirst-allaying character, 1,000 thirst quenchers, and a compact first-aid case. It is stated that several large shipping companies are adopting it, as they recognise that such a case in a lifeboat will prevent men from drinking salt water, which is often attended with fatal consequences. Furness, Withy & Co. were, it is stated, the first to adopt it for their large fleet of steamers. During the war the profits accruing will be devoted to charity. Enquiries should be addressed 5, Richmond Street, Liverpool.

Japan's Shipbuilding Energy.—In July, 1916, the President of the Tokyo Kisen Kaisha started to reclaim a desolate sandy tract, 12 miles north of Yokohama, by filling and raising it with sand pumped from the sea front. In August last he commenced building slips. By February of this year the keel of the first 11,000 tons cargo ship was being laid, and the vessel was to be launched this month. Three other similar boats have been begun, and four more building slips are nearly completed. Details of the plant indicate that it is all of the latest type, and, with the exception of two or three minor machines, all the shipbuilding plant is of Japanese manufacture, and all (except the steam hammers) is driven by electricity.

Shipping Controller for France.—A Reuter message from Paris states that a decree has been issued establishing an Under Secretaryship of Maritime Transports and the Merchant Marine, the holder of which, under the authority of the Minister of Public Works, will have the entire charge of the Department of Maritime Transports. The new Under Secretary will thus be in charge of all measures which can contribute to the increase of the merchant marine, everything which concerns marine insurance, and all functions which the Decree of January 17, 1917, conferred on the Under Secretary of State for the Merchant Marine. In consequence the Under Secretaryship for the Merchant Marine established by decree of December 14, 1916, is abolished.

Allan Line Changes.—The Canadian Pacific Ocean Services, Ltd., 8, Waterloo Place, London, S.W. 1, announce that they have taken over the management, operation and control of the Allan Line steamers and the offices of the Allan Line in London, Glasgow, Dundee and Londonderry. The Allan Line office at 19, James Street, Liverpool, has been closed and transferred to the Canadian Pacific Ocean Services, Ltd., Royal Liver Building, Liverpool, where all operations of the joint Allan-Canadian Pacific Services from that port will henceforth be conducted. The number and combined tonnage of Canadian Pacific and Allan Line vessels on the Atlantic and Pacific for which the Canadian Pacific Ocean Services act as managers and agents is 39 vessels of approximately 400,000 tons (including seven vessels now building). Passengers and freight services will be maintained between Liverpool, London, Glasgow, Bristol and Havre to Canada and the United States and between Vancouver and Japan, Manila and China.

Opposition to Cardiff Shipbuilding Scheme.—At a meeting of the Cardiff City Council, on July 9, a letter dated July 6 was read from Eland, Nettleship & Butt, 4, Trafalgar Square, London, W.C., solicitors to the promoters of the new Cardiff shipbuilding project, in which it was stated that the Cardiff City Council had passed a resolution expressing their great appreciation of the welcome and support the promoters might rely upon. Similar resolutions of support have been passed by the Board of Guardians, the Business Club, other representative societies, local landowners, and the Taff Vale Railway Company. Strenuous opposition, however, has been put forward by the Penarth Pontoon Company. It is hoped, therefore, that the services of the Lord Mayor, or some other member of the City Council, may be enlisted in endeavouring to remove any opposition to a project which must result in great benefit to the City of Cardiff and its surroundings. It has consequently been decided to ask the Lord Mayor to interest himself in the matter.

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Name and Type.	Tonnage	Dimensions. Draught in ( ).	Sold by, to	Builders, hull and year.	Machinery and builders.	Remarks.
Ainsdale, s.v...	1,825 gr. 1,725 net 2,900 d.w.	270′ × 39½′ × 23½′ (21′ 2″)	P. Iredale & Porter, Ltd., Liverpool, to buyers not stated	C. J. Bigger, Londonderry (1890)	-	Price about £22,000.
B.A.H.W. No. 15 (single dk.)	449 gr. 234 net 470 d.w.	158′ × 29½′ × 8½′	C. H. Walker & Co., London, to French buyers	C. H. Walker & Co., Sudbrook (1913)	15, 30 × 20 (Plenty & Son, Newbury)	-
Bro, ss. (single dk.) (ex *Barbro*)	908 gr. 408 net 1,200 d.w.	200′ × 30′ × 13′ (14′ 7″)	"Bro" S.S. Co., Porsgrund, to buyers not stated	Frammes Mek Verks, Sandefjord (1901)	14, 24, 37 × 27 (Akers Mek Verks, Christiania)	Price about £30,500. Sold in 1915 for about £15,500.
Bright Wings, ss. (single dk.)	3,116 gr. 1,992 net 5,500 d.w.	331′ × 49′ × 21½′ (20′ 7″)	Wing S.S. Co., London, to buyers not stated	Russell & Co., Pt. Glasgow (1909)	23, 37, 61 × 42 (J. G. Kincaid & Co., Greenock)	-
Celtic Glen, s.v. (ex *Iquique*)	1,941 gr. 1,859 net 3,150 d.w.	267½′ × 39′ × 23½′ (21′ 3″)	Celtic Glen Co., Liverpool, to Mr. Herbert Ford, Birmingham	W. Hamilton & Co., Pt. Glasgow (1892)	-	Price about £23,000.
Celtic Queen, s.v.	1,830 gr. 1,738 net 2,850 d.w.	261′ × 38½′ × 23′ (22′ 6″)	Acties. Celtic, Sandefjord, to buyers not stated	W. Pickersgill & Sons, Sunderland (1891)	-	Price about £25,000.
Cairnavon, ss. (single dk.)	1,591 gr. 981 net 2,600 d.w.	250′ × 36½′ × 18′ (17′ 8″)	Cairn Line of Steamships, Newcastle, to Ch. Salveson & Co., Leith	Short Bros., Ltd., Sunderland (1905)	19, 30, 48 × 36 (Blair & Co., Stockton)	-
Dolbadarn Castle, s.v. (ex *Earnmount*, ex *Haytor*)	1,989 gr. 1,860 net 3,400 d.w.	267′ × 40′ × 23½′ (21′ 5″)	Dolbadarn Castle S. Co., Liverpool, to Anglo-Saxon Petroleum Co., London	W. Hamilton & Co., Pt. Glasgow (1897)	—	Price about £31,500. Delivery at Santos.
Joseph Chamberlain, ss. (single dk.)	3,709 gr. 2,338 net 6,300 d.w	350½′ × 50′ × 23½′ (21′ 6″)	Joseph Chamberlain S.S. Co., W. Hartlepool, to W. & C. T. Jones, Cardiff	Wm. Gray & Co., W. Hartlepool (1910)	25, 40½, 67 × 45 (Cen. Mar. Eng. Wks., W. Hartlepool)	Price about £25,000.
Juteopolis, s.v.	2,842 gr. 2,652 net 4,450 d.w.	310′ × 45′ × 25′ (22′ 9″)	G. Windram & Co., Liverpool, to the Marine Nav. Co. of Canada, Montreal	W. B. Thompson & Co., Dundee (1891)	—	Price about £30,000. Sold 1911 for about £6,500.
Lord Erne, ss.	4,239 gr. 2,714 net 7,100 d.w.	375½′ × 50′ × 25½′ (23′ 6″)	Irish Shipowners' Co., Belfast, to buyers not stated	Napier & Miller, Ltd., Glasgow (1900)	27½, 44½, 72½ × 48 (D. Rowan & Co., Glasgow)	—
Miramichi, ss. (shelter dk.)	3,624 gr. 2,306 net 6,605 d.w.	340′ × 48½′ × 25½′ (25′ 6″)	W. Gowan & Co., Cape Town, to buyers not stated	J. L. Thompson & Sons, Sunderland (1902)	25, 42, 68 × 45 (J. Dickinson & Sons, Sunderland)	Price about £40,000.
Nippo Maru, ss. (ex *Benmohr*)	3,163 gr. 2,331 net 4,600 d.w.	340′ × 41½′ × 24′ (22′ 3″)	Okazaki Kisen, Kabushiki Kaisha Kobe, to buyers not stated	A. Stephen & Sons, Glasgow (1893)	25, 41, 67 × 42 (A. Stephen & Sons)	Price about £150,000. Sold in 1911 for about £13,000.
Pomona, ss. (awning dk.)	868 gr. 648 net	199½′ × 30′ × 11½′ (10′ 7″)	Dodero Hermanos, Monte Video, to French buyers	David J. Dunlop & Co., Pt. Glasgow (1883)	24½, 46 × 30 (David J. Dunlop & Co.)	—
Rollo, s.v. ...	614 gr. 578 net 850 d.w.	163½′ × 31½′ × 18½″	M. Hannestad, Fredrikshald, to Arthur Tate & Co., Newcastle-on-Tyne	J. T. Tryde, Grimstad (1883)	—	—
Saint Louis, ss.	617 gr. 362 net 850 d.w.	209½′ × 26′ × 15½′ (16′)	L. Castel, Cette, to buyers not stated	Message. Maritimes, La Ciotat (1889)	14, 16¾, 30 × 28½ (Forges & C. de la Mediterranée, Marseilles)	Price about £47,500.

A single-deck steamer with a carrying capacity of about 8,000 tons on a 24-ft. 6-in. draught, at present building by Wm. Gray & Co., West Hartlepool, with engines 25, 41, 68 in. by 48 in., and now ready for delivery, has been sold for about £190,000. She was disposed of in April last for about £165,000.

New Type of Submarine.—An Exchange message from Copenhagen states that several Swedish papers contain statements concerning a large type of new German submarine that has been constructed. The vessel has a length of 140 metres, greatest breadth 11·3 metres, engines 20,000 h.p., a speed of 28 knots above the surface and 15 knots below. It is capable of carrying 76 torpedoes, 150 mines, and is provided with six 11·9 centimetre cannon.

SHIPPING SHARE MARKET.

The past week's steady business in the securities of steamship companies indicates that investors have declined to be scared by the sensational statements in the House of Commons regarding the profits made by Mr. Bonar Law from his investment in shipping companies. It has now been shown that the profits made referred almost solely to single-steamship companies which are not representative of the great bulk of shipping investors whose interests are mainly in the issues of the big mail-carrying and other lines. Although there are no special features to record, business is on a very healthy basis, and in many directions the recent scare respecting control over profits is regarded as having effected a great deal of good in cleaning up the market of weak holders. It is now recognised that there are no tip-and-run profits to be made out of the market, and purchasers must expect to lock up their holdings as a solid investment. Provincial centres have been making several enquiries for shares during the week, and there is an indication that the provincial markets are getting rather bare of stock. In shipbuilding and kindred companies' issues there has been an appreciable hardening with fractional advances in several instances. The Furness Withy group has been specially strong. There was some talk during the past week of a big amalgamation of several interests with a view to taking special steps to develop after-the-war business hitherto held by countries now at war with us. The idea, as formulated on the Stock Exchange, appears to be a big shipping development combination on the lines of the recent trade bank, not for the purpose of engaging directly in shipping business, but for the purpose of uniting British shipping companies with a view to preventing overlapping. It is questioned, however, whether the present is the best time to bring the scheme forward in view of possible opposition brought about by the recent erroneous statements respecting the profits made by shipping companies. In the absence of some scheme of the kind it is feared that a great deal of economic waste and overlapping will be created by British steamship companies which have done well out of the war and are desirous of developing in other fields immediately it is over. Marine insurance shares have been very strong on the prohibition by the United States of German marine insurance, which means that a good deal of re-insurance business will come to British companies.

SHIPPING, SHIPBUILDING, ENGINEERING AND MARINE INSURANCE SHARE LIST.

SHIPPING.

Name.	Share and paid.	Extreme quotations, 1916.	Last ann. div. % or per share.	Yield. %	Last Quotation	Rise or Fall.
	£					
African S.S.	20	33—23½	10	6¼	29	
Allan Line ... ... Deb.	100	—	4	4⅓	92	
Anchor Line ... Cum. pref.	10	9⅝—9⅛	5½	5¼	9½	+ ½
Do. ... ... Deb.	Stk.	105½—102½	4½	4⅓	102	
Argentine Nav. ... Cum. pref.	1	19/6—11/-	Nil.	Nil.	13/6	
Do. ... ... Deb.	Bds.	95⅜—84	6	6	99	
Australasian Un. S. Nav. Deb.	Stk.	83⅛—80⅜	4	5⅛	78	−2
Belfast Steam ... ... "A"	10 (5pd.)	—	5	5	5	
British & African Nav. Deb.	Stk.	98½—91	4½	4⅔	102	
British India Nav. ... Deb.	Stk.	91½—88¼	4½	5⅜	83	+2
British S.S. Invest. Trust Def.	Stk.	35/- -19/-	30*	8½	355	+5
Do. ... ... Pref.	Stk.	108 105½	6	6	101	
Do. ... ... Deb.	Stk.	79—77½	4½	6¼	74	−2
Cairn Line ... ... Deb.	Bds.	99—88	5	5⅝	90⅜—91	
Do. ... ... Ord.	1	—	20†	9⅝	42/6	−2/6
Clan Line ... ... Ord.	10	32½—22½	25	9⅝	26½	
Court Line ... ... Ord.	£1	42/- 26/-	20	12	33/9	
Cunard SS. ... ... Ord.	1	101/- 68/-	20*	5	81/-	
Do. ... Cum. pref.	Stk.	95 89	5	5⅛	82	
Do. ... ... Deb.	Stk.	99½ 93¼	4½	4⅔	96	
Elder Line ... ... Deb.	Stk.	97½—89⅝	4½	4⅜	103	
Elder Dempster ... Cum. pref.	1	20/6—18/1½	5⅜	5⅛	19/-	−/3
Do. ... ... Deb.	Stk.	92⅝—88⅛	5	5⅝	85	−2
Ellerman Lines ... Pref. Ord.	10	9¹⁵⁄₁₆—9½	6¼	6	8⅛	+ ⅛
Do. ... Guar. pref.	10	9¹⁵⁄₁₆—9⅝	4½	5¼	8½	
France Fenwick ... Cum. pref.	5	98⅝—92 6	5½	6¼	90/-	
Furness, Withy ... Ord.	1	61/3—34/3	20*	9⅝	48/6	
Do. ... Cum. pref.	10	9½—7½	5	6¼	8¼	
General Steam Nav. Ord.	7½	12⅞—8½	15	7⅛	22/6	
Do. ... ... Pref.	8	7¼—6⅝	6	7⅝	15/-	
Houlder Line ... Cum. pref.	5	83/9—67/6	5½	7¼	81,10½	
Do. ... ... Deb.	Stk.	—	4½	4⅓	93	
Houlder Bros. ... Cum. pref.	5	—	5⅜	5⅝	4	
Do. ... ... Deb.	Stk.	—	4½	5⅝	82	
India Gen. Nav. & Rly. ... Ord.	10	12—8⅜	6	5¾	10½	
Indo-China N. ... Pref. Ord.	5	5⅞—90/-	6	6¼	90 –	
Irrawaddy Flotilla	40	—	15	5⅛	116	
Khedivial Mail ... ... Ord.	1	37 - 10/	25	13⅝	37/-	−1/-
Do. ... ... Pref.	5	77/6 -60/6	5½	7⅛	72/6	−1/3
Do. ... ... Deb.	Stk.	94¼—87¼	4½	4⅔	95	-1/-
King Line ... ... Ord.	1	—	16*	9⅝	37 -	
Lamport & Holt ... Cum. pref.	£1	20/9—18/9	6	6	19/6	
Leyland (F.) ... Cum. pref.	10	8¼ 6⅛	5	6⅝	7⅛	
Mercantile SS. ... ... Ord.	5	18⅝—12	40	13	15	
Do. ... ... Pref.	1	20/1⅛ 20/	5	6¼	16 3	
Moor Line ... ... Ord.	10	—	30	13	21½	
Nelson Steam Nav. ... Deb.	100	98¼—97½	5	5⅛	98⅝	
New Zealand ... ... Ord.	£10	—	8	2⅝	32⅝	
Do. ... ... Deb.	Stk.	90¼—88	4	4⅓	86	−2
Nitrate Producers SS. ... Ord.	5	25⅛ 18	30	6¼	24⅛	
Do. ... Cum. pref.	5	—	5	5	5	
Oceanic Steam. Nav. ... Deb.	100	99—95⅛	4⅛	4⅓	96	+12
Orient.Stm.Nav.Co. Cum. pref.	10	9⅛—9⅜	5	5⅝	9	
Do. ... ... Deb.	100	98—91⅝	4½	5⅛	89	
P. & O. S. N. ... Cum. pref.	100	100—91	5	5⅝	89	
Do. ... ... Def.	100	349—270	18	5¼	325	+2
Do. ... ... Deb.	Stk.	71—69	3½	5⅛	65½	
Prince Line	1	95/—26/	30	8⅛	85/-	-2/6
R.M.S.P. ... ... Ord.	100	134⅛—97⅝	7	6⅛	117⅛	
Do. ... ... Pref.	Stk.	86⅛—76½	5	6¼	81	
Do. ... ... Deb.	Stk.	89—86	4½	5⅛	83	
Shaw, Savill & Alb. Cum. pref.	5	95/ —86 5	5	5⅝	81/3	
Shell Transport ... ... Ord.	1	6 1⅝	35	5⅜	5⅛	−1⅜
Do. ... Cum. pref.	10	10⅛ 9	5	5⅝	9⅛	− ¼
Sutherland SS. Co.	£1	69/6 —41/6	30	10	54/6	
Union-Castle SS. Cum. pref.	10	7¼ – 7	4½	5	7⅞	
Do. ... ... Deb.	Stk.	92⅝ 86¼	4	4⅔	86	−1½
West Hartlepool ... ... Pref.	10	8⅛—7½	5⅜	7¼	7½	- ⅛

INSURANCE.

Alliance	20 (2·4 pd.)	10½—8⅜	12 -	6⅜	9⅛	
Indem. Mutual Marine ...	15 (3 pd.)	13⅜—9⅝	15/-	5	2⅝	
London Assurance	25 (12½ pd.)	52⅜—42½	20	6	54	
Marine Insurance	25 (15 pd.)	36¼ 33⅜	45/-	6	15xd	+7½
Merchants' Marine Insurance ...	10 (2½ pd.)	7⅛—71/3	10	6	10½	+ ⅜
N. British & Mercantile Ord.	25 (6¼ pd.)	34⅛—29	40/-	6⅜	34	+1¼
Phœnix Assurance	10 (1 pd.)	7⅛—5⅜	40	7	6½	+ ⅛
Reliance Marine	10 (2 pd.)	—	20	4⅜	7½	
Royal Exchange Assurance ...	Stk.	189⅜—181	10	5⅛	212	+12
Sea Insurance	10 (2 pd.)	19⅜—18⅛	10	5⅜	21½	
World Marine, Limited ...	5 (2 pd.)	61/3—35/-	5	5	5	+ ⅛

IRON AND STEEL.

Name.	Share and paid.	Extreme quotations, 1916.	Last ann. div. % or per share.	Yield. %	Last Quotation	Rise or Fall.
	£					
Babcock & Wilcox... ... Ord.	1	64/6-47/10⅜	15	5	60/-	+ -/9
Baldwins ... Cum. pref.	1	1⅛—1	5⅜	5⅜	20/-	
Do. ... ... Deb.	Stk.	87⅜—86⅛	4⅜	5⅛	84	
Bayliss, Jones ... Cum. pref.	1	—	5	7¼	⅛	
Bell Bros. ... ... Cum. pref.	10	10⅜—9,⅜	6	6	10	
Do. ... ... Deb.	Stk.	80—78½	5	6⅜	75½	+2
Bessemer (Henry) ... Ord.	1	29/—26/-	12½	12	25/3	
Bolckow Vaughan ... Ord.	1	25/10½—18/-	11	9⅛	25/6	
Do. ... ... Cum. pref.	20	19—18	5	5⅝	16½	
Cargo Fleet Iron ... ... Ord.	1	23/3-13/10½	3	3⅛	22/-	+ - 7½
Do. ... ... Deb.	100	86½—84	4½	5⅓	82	−2
Consett Iron Co. ... ... Ord.	1	89/4½—65/3	50	11	92/6	+3/6
Dominion Iron & Steel	Bds.	83—78	5	6⅜	78	
Dorman, Long ... ... Ord.	1	36/—22/3	14	9	37/-	
Do. ... ... Deb.	Stk.	97⅜—97	4	5¼	73	−1
Ebbw Vale Steel & Iron Ord.	1	28/7⅜—19/-	12½	9⅜	28/6	— -/3
Guest, Keen & Nettefids Ord.	1	71/3—60/-	15*	9⅜	83/9	+6/3
Do. ... ... Cum. pref.	5	5¼—5⅛	5	4⅝	5⅛	
Do. ... ... Deb.	Stk.	82⅜—80½	4	5⅛	75	
Hadfield's Steel Foundry Ord.	1	82/6 - 69/-	30	7⅜	83/9	
Ibbotson Bros.	5 (4 pd.)	8—6	7½	4⅜	6¼	
Jessop (W.) & Sons ... Ord.	5 (4 pd.)	9—8	15*	7⅜	8⅝	
Lanarkshire Steel Cum. pref.	10	—	5	7⅛	7	
Lysaght (J.) ... Cum. pref.	1	22/7⅜—20,3	6	6	20/-	
Do. ... ... 2nd pref.	1	21/1⅜—21/-	6	6	20/-	
Manganese Bronze ... Ord.	1	—	6	11	⅛	
Do. ... ... Cum. pref.	1	—	6	8	⅜	
North-Eastern Steel ... Deb.	Stk.	—	4½	—	—	
Palmers Ship & Iron "A"	1	12/6—9/-	Nil.	Nil.	9/9	
Scott (Walter) ... ... Ord.	1	26/3—17/9	15	12½	24/-	+2/-
Do. ... ... Pref.	1	16/10⅜—16/3	6	7⅜	16/3	+1/3
Sheffield Forge ... ... Ord.	1	—	15	6⅝	53/6	
Shelton Iron & Steel ... Ord.	1	20/4⅛—15/-	7½	8¼	19 7½	
Do ... ... Deb.	100	94—92⅜	5	5½	91½	
S. Durham Steel & Iron Ord.	1	37/6—27/-	10	6⅝	34/6	— -/3
Do. ... ... Cum. pref.	1	21 — 19/	6	6⅛	20/-	
Do. ... ... Deb.	Stk.	82—80	4½	5⅝	80	−1
Steel Co. of Scotland ... Ord.	10	—	10	10	12/1/-	
Stewarts & Lloyds Pref. ord,	10	18⅜—17	10	5½	15⅜	
Do. ... ... Cum. pref.	10	—	6	4⅜	13⅛	
Stone (J.) ... ... Cum. pref.	10	—	5	6¼	8	
United States Steel ... Ord.	100$	144⅜—83⅛	8	6¼	116¼	+2½
Do. ... ... Cum. pref.	100$	124⅛—112¼	7	5½	128	
Vickers Ltd. ... ... Ord.	1	40/3—33/6	12½	7½	39/-	+ -/6
Do. ... ... Pref.	Stk.	93—85	5	6	84	+1½
Do. ... ... Deb.	Stk.	83—75	4	5⅛	77⅛	
Weardale Steel ... Def. ord.	1	34/—19/1½	19½	13⅝	28/-	+ -/9
Do. ... ... Cum. pref.	1	23 6 —17 6	6	6	21/6	+ -/6
Do. ... ... Deb.	Stk.	70⅜—69¼	4	6	65½	
Workington Iron & Steel Ord.	1	24/3—14/3	10	7⅜	27/6	

SHIPBUILDING AND MARINE ENGINEERING.

Armstrong, Whitworth Ord.	1	43/—34,6	12½	7	39/9	
Do. ... ... Cum. pref.	5	75,—67 6	4	5⅔	70/-	
Do. ... ... Deb.	Stk.	80⅜—75	5	6⅝	75/-	
Beardmore (W.) ... ... Deb.	100	99 92	4⅜	5	91 –	−6
Brown (John) ... ... Ord.	1 (15s. pd.)	27/3—20 6	12½	8⅛	25/6	
Do. ... ... Cum. pref.	10	10—5⅜	5	5⅜	8⅝	— ¼
Cammell Laird ... ... Ord.	5	7—98/-	10	8	6⅝	+ ¼
Do. ... ... Cum. pref.	5	88/—76/3	5	6¼	80/-	
Do. ... ... Deb.	100	93⅜—85	4½	5⅜	81	−2
Dunlop (Jas.) ... ... Ord.	1	19 7⅛-13/4⅜	10	10⅝	18/6	+1/-
Do. ... ... Cum. pref.	1	17/1⅛-16/4⅜	6	7⅜	17 6	
Fairfield Shipbldg Cum. pref.	10	8⅜—8,⅝	6	7⅛	8⅛xd	+ ½
Fleming & Ferguson ... Ord.	10	—	10	7	14⅜	
Gray (Wm.) ... ... Deb.	100	100⅛—99¼	4½	4⅜	100¼	
Hawthorn (R. & W.) Leslie Ord.	10	15⅜—14	12½	8	15¼	
Henderson (D. & W.) Cum. pref.	1	—	5	8⅛	⅞	
Richardsons Westgarth Ord.	1	7/9—2,10⅜	Nil.	Nil.	6/3	+1/3
Do. ... ... Cum. pref.	1	15/7⅜—8/-	Nil.	Nil.	14/-	+ -/6
Do. ... ... Deb.	Stk.	69—67⅛	4⅜	6¼	62	
Simons (W.) ... Cum. pref.	10	—	5	5	9⅛	
Swan, Hunter & W. R. ... Ord.	1	35/6—26/-	12½	7	39/-	
Do. ... ... Cum. pref.	1	18/9—17/-	5	5⅞	17/6	
Do. ... ... Deb.	Stk.	82 –80⅛	4½	5⅝	78	−1
Thornycroft (John I.) ... Ord.	1	38⅜—21/9	17⅛	9⅜	36/3	−1/3
Do. ... ... Cum. pref	1	18/6—16/3	6	6⅝	16/9	
Do. ... ... Deb.	100	95⅜—88	5	5¼	86½	
Wallsend Slipway ... Ord.	1	2 1⅛	10	5	2	
Do. ... ... Cum. pref.	1	1—1	5	5	1	

* Including bonus. † Also 20 % in shares.

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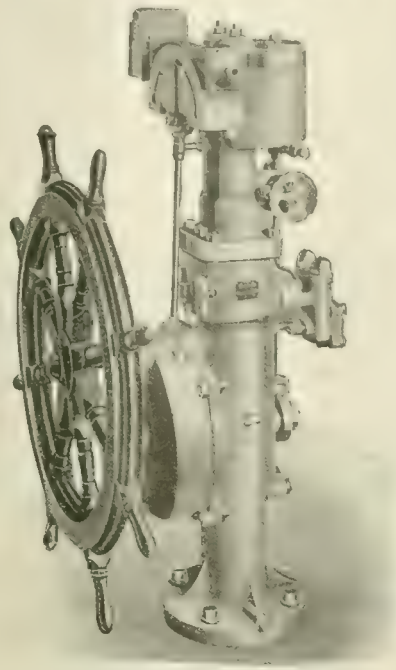

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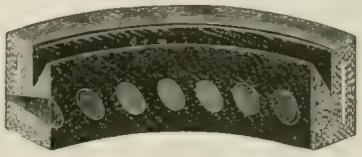

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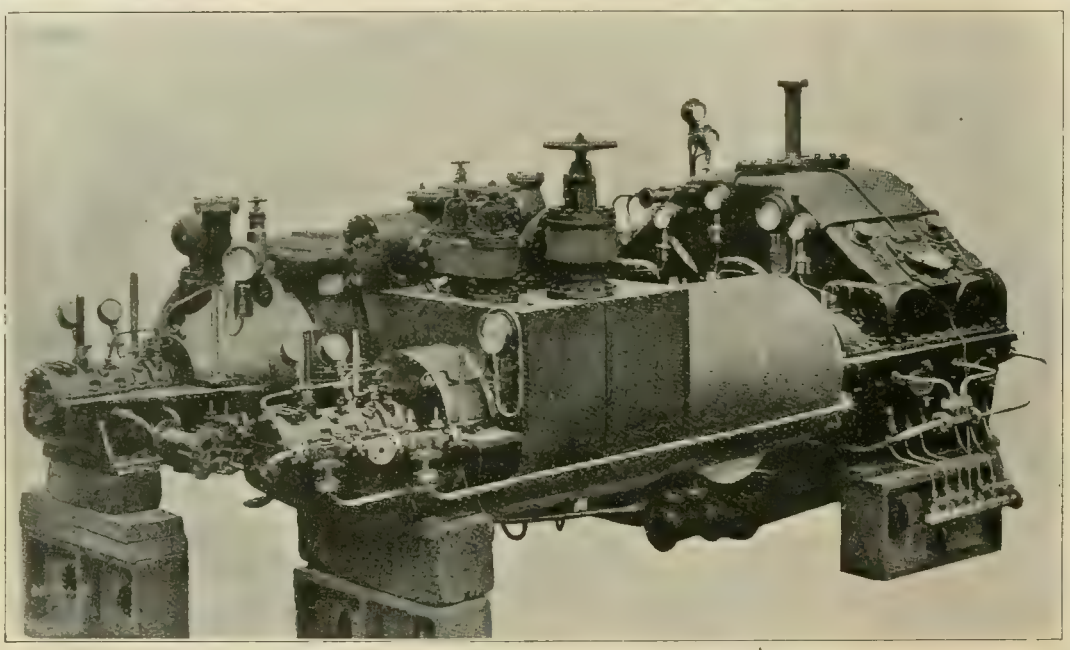

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Scottish Tube Co., Ltd., 34, Robertson Street, Glasgow.
Stewarts & Lloyds, Ltd., 41, Oswald Street, Glasgow.

DIESEL OIL (Mexican)—
Anglo-Mexican Petroleum Co., Ltd., Finsbury Court, E.C.

DIVING APPARATUS—
Heinke, C. E., & Co., 88, 89, Grange Road, Bermondsey, S.E.

DOCK GATES—
Chalmers, Wm., & Co., Ltd., Ruthergien, nr. Glasgow.
Hamilton, Wm., & Co., Ltd., Port Glasgow, Scotland.
Swan, Hunter & Wigham Richardson, Ltd., Wallsend-on-Tyne.

DOORS (Watertight)—
British Thomson-Houston Co., Ltd., Rugby.
Stone, J., & Co., Ltd., Deptford, S.E.

DREDGE PLANTS –
Cochrane, Wm., & Co., Ltd., Rutherglen, nr. Glasgow.
Simons, Wm., & Co., Ltd., Renfrew, nr. Glasgow.

DRILLING MACHINES—
Campbells & Hunter, Ltd., Dolphin Foundry, Leeds.
Herbert, Alfred, Ltd., Coventry.
Scott Bros., Keighley.
Universal Machinery Corporation, Ltd., 326, Old Street, London, E.C.

DRILLS—
Chatwin, Thos., Ltd., Gt. Tindal Street, Birmingham.

DRILLS (Pneumatic and Electric)—
United States Metallic Packing Co., Ltd., Bradford.

ELECTRIC CRANES (See Cranes).

ELECTRIC DERRICKS—
British Thomson-Houston Co., Ltd., Rugby.
British Westinghouse Electric & Mfg. Co., Ltd., Trafford Park, Manchester.

ELECTRIC DYNAMOS & MOTORS—
Allen, W. H., Son & Co., Ltd., Queen's Engineering Works, Bedford.
Boothroyd, H. T., Ltd., Bootle, Liverpool.
British Thomson-Houston Co., Ltd., Rugby.
British Westinghouse Electric & Mfg. Co., Ltd., Trafford Park, Manchester.
Clarke, Chapman & Co., Ltd., Gateshead-on-Tyne.
Crompton & Co., Chelmsford.
Electromotors, Limited, Louisa Street Openshaw, Manchester.
Greenwood & Batley, Ltd., Albion Works, Leeds.
Holmes, J. H., & Co., Portland Road, Newcastle-on-Tyne.
Mather & Platt, Ltd., Manchester.
Mawdsley's, Limited, Dursley, Glos.
Phœnix Dynamo Manufacturing Co., Ltd., Bradford.
Sunderland Forge & Engineering Co., Ltd., Sunderland.

ELECTRIC FITTINGS—
British Thomson-Houston Co., Ltd., Mazda House, 77, Upper Thames Street, London, E.C.
McGeoch, Wm., & Co., Ltd., 28, West Campbell Street, Glasgow.
Sunderland Forge & Engineering Co., Ltd., Sunderland.

ELECTRIC HEATING & COOKING APPARATUS—
British Thomson-Houston Co., Ltd., Rugby.
Crompton & Co., Chelmsford.
McGeoch, Wm., & Co., Ltd., 28, West Campbell Street, Glasgow.

ELECTRIC LAMPS—
British Thomson-Houston Co., Ltd., Mazda House, 77, Upper Thames Street, London, E.C.
British Westinghouse Electric & Mfg. Co., Ltd., Trafford Park, Manchester.
McGeoch, Wm., & Co., Ltd., 28, West Campbell Street, Glasgow.

ELECTRIC LIGHTING—
Boothroyd, H. T. Ltd., Bootle, Liverpool.
British Thomson-Houston Co., Ltd., Mazda House, 77, Upper Thames Street, London.
British Westinghouse Electric & Mfg. Co., Ltd., Trafford Park, Manchester.
Clarke, Chapman & Co., Ltd., Gateshead-on-Tyne.
Electromotors, Limited, Louisa Street, Openshaw, Manchester.
Holmes, J. H., & Co., Portland Road, Newcastle-on-Tyne.
Lister, R. A., & Co., Ltd., Dursley.
Mather & Platt, Ltd., Manchester.
Sunderland Forge & Engineering Co., Ltd., Sunderland.

ELECTRIC-LIGHTING PLANT—
Belliss & Morcom, Ltd., Ledsam Street Works, Birmingham.
British Thomson-Houston Co., Ltd., Rugby.
British Westinghouse Electric & Mfg. Co., Ltd., Trafford Park, Manchester.
Clarke, Chapman & Co., Ltd., Gateshead-on-Tyne.
Crompton & Co., Chelmsford.
Electromotors Limited, Louisa Street, Openshaw, Manchester.
Fyfe Wilson & Co., 155a, St. Vincent Street, Glasgow.
Glenifer Motors, Ltd., Temple Works, Anniesland, Glasgow.
Greenwood & Batley, Ltd., Albion Works, Leeds.
Holmes, J. H., & Co., Portland Road, Newcastle-on-Tyne.
Mather & Platt, Ltd., Manchester.
Mawdsley's, Limited, Dursley, Glos.
Norris, Henty & Gardners, Ltd., 87, Queen Victoria Street, London, E.C.
Petters, Ltd., 73, Queen Victoria Street, London, E.C.
Scott, Jas., Ltd., Bootle, Liverpool.
Sunderland Forge & Engineering Co., Ltd., Sunderland.

ELECTRIC WIRES—
British Thomson-Houston Co., Ltd., Mazda House, 77, Upper Thames Street, London, E.C.
British Westinghouse Electric & Mfg. Co., Ltd., Trafford Park, Manchester.

ELECTRICAL CONTRACTORS—
Clarke, Chapman & Co., Ltd., Gateshead-on-Tyne.

ELECTRICAL CONTRACTORS (*contd*).—
Holmes, J. H., & Co., Portland Road, Newcastle-on-Tyne.
Low, Archibald, & Sons, Ltd., 78, Merkland Street, Partick, Glasgow.
Martin, W. C., & Co., 10, West Campbell Street, Glasgow.
Mather & Platt, Ltd., Manchester.
Scott, Jas., Ltd., Bootle, Liverpool.
Sunderland Forge & Engineering Co., Ltd., Sunderland.

ELECTRICAL ENGINEERS—
Boothroyd, H. T., Ltd., Bootle, Liverpool.
British Thomson-Houston Co., Ltd., Rugby.
British Westinghouse Electric & Mfg. Co., Ltd., Trafford Park, Manchester
Chadburn's (Ship) Telegraph Co., Ltd., Cyprus Road, Bootle, Lancs.
Clarke, Chapman & Co., Ltd., Gateshead-on-Tyne.
Crompton & Co., Chelmsford.
Electromotors, Limited, Louisa Street, Openshaw, Manchester.
Fyfe Wilson & Co., 155a, St. Vincent Street, Glasgow.
Graham, Alfred, St. Andrew's Works, Crofton Park Road, S.E.
Holmes, J. H., & Co., Portland Road, Newcastle-on-Tyne.
Mather & Platt, Ltd., Manchester.
Mawdsley's, Limited, Dursley, Glos.
Scott, Jas., Ltd., Bootle, Liverpool.
Sunderland Forge & Engineering Co., Ltd., Sunderland.

ELECTRICAL INSTRUMENTS—(Ammeters)—
British Thomson-Houston Co., Ltd., Rugby.
British Westinghouse Electric & Mfg. Co., Ltd., Trafford Park, Manchester.
Crompton & Co., Chelmsford.
Holmes, J. H., & Co., Portland Road, Newcastle-on-Tyne.

ELECTRICAL INSTRUMENTS (Circuit Breakers)—
British Thomson-Houston Co., Ltd., Rugby.
British Westinghouse Electric & Mfg. Co., Ltd., Trafford Park, Manchester.
Holmes, J. H., & Co., Portland Road, Newcastle-on-Tyne.

ELECTRICAL INSTRUMENTS (Relays)—
British Thomson-Houston Co., Ltd., Rugby.
British Westinghouse Electric & Mfg. Co., Ltd., Trafford Park, Manchester.
Holmes, J. H., & Co., Portland Road, Newcastle-on-Tyne.

ELECTRICAL INSTRUMENTS (Voltmeters)—
British Thomson-Houston Co., Ltd., Rugby.
British Westinghouse Electric & Mfg. Co., Ltd., Trafford Park, Manchester.
Compton & Co., Chelmsford.
Holmes, J. H., & Co., Portland Road, Newcastle-on-Tyne.

EMERY WHEELS—
Sterne, L., & Co., Ltd., Crown Iron Works, Glasgow.

ENAMEL MANUFACTURERS—
Holzapfels, Ltd., Newcastle-on-Tyne.
Websters Ltd., Hull.

ENGINE & DECK STORES—
McGeoch, Wm., & Co., Ltd., 28, West Campbell Street, Glasgow.
Metallic Valve Co., Colonial House, Water Street, Liverpool.

ENGINE FITTINGS—
McRobie, John, & Sons, 94, Elliott Street, Cranstonhill, Glasgow.

ENGINE-ROOM OUTFITS—
Grieve, T., & Sons, Bedford Street, North Shields.

EVAPORATORS—
Central Marine Engine Works, West Hartlepool.
Richardsons, Westgarth & Co., Ltd., Hartlepool.
Weir, G. & J., Ltd., Cathcart, Glasgow.

EXTRUDED METALS (Brass and Bronze)—
Bolton, Thos., & Sons, Ltd., 57, Bishopsgate, E.C.
McKechnie Bros., Ltd., Metal Works, Rotton Park Street, Birmingham.

EXTRUDED METALS (Brass, Bronze, Copper, Delta Metals)—
Delta Metal Co., Ltd., E. Greenwich, London, S.E.

FANS—
Allen, W. H., Son & Co., Ltd., Queen's Engineering Works, Bedford.
Boothroyd, H. T., Ltd., Bootle, Liverpool.
British Thomson-Houston Co., Ltd., Rugby.
British Westinghouse Electric & Mfg. Co., Ltd., Trafford Park, Manchester.
Davidson & Co., Ltd., Sirocco Engineering Works, Belfast.
Electromotors, Limited, Louisa Street, Openshaw, Manchester.
Hogan & Wardrop, 2, Gresham Buildings, Basinghall Street, London, E.C.
Keith, James, & Blackman Co., Ltd., 27, Farringdon Avenue, London, E.C.
Mawdsley's, Limited, Dursley, Glos.

FEED-WATER HEATERS—
Central Marine Engine Works, West Hartlepool.
Richardsons, Westgarth & Co., Ltd., Hartlepool.
Weir, G. & J., Ltd., Cathcart, Glasgow.

FENCING & GATES—
Bayliss, Jones & Bayliss, Ltd., Victoria Works, Wolverhampton.

FILES
Brown, John, & Co., Atlas Works, Sheffield.
Spencer, John, & Sons, Ltd., Newburn-on-Tyne.

FILTERS (Marine)—
Central Marine Engine Works, West Hartlepool.
Cockburns, Ltd., Cardonald, nr. Glasgow.
Mather & Platt, Ltd., Manchester.

FIREBARS—
Goulds' Foundries, Ltd., Cardiff.

FIRE EXTINGUISHERS—
Low, Archibald, & Sons, Ltd., 78, Merkland Street, Partick, Glasgow.
Mather & Platt, Ltd., Manchester.

FLOATING DOCKS—
Chalmers, Wm., & Co., Ltd., Rutherglen, nr. Glasgow.
Hamilton, Wm., & Co., Ltd., Port Glasgow, Scotland.
Swan, Hunter & Wigham Richardson, Ltd., Wallsend-on-Tyne.

FLOOR COVERING—
Docker Bros., Ltd., Metropolitan Road, Saltley, Birmingham.

FORCED DRAUGHT—
Davidson & Co., Ltd., Sirocco Engineering Works, Belfast.
Howden, J., & Co., Ltd., Scotland Street, Glasgow.
Keith, James, & Blackman Co., Ltd., 27, Farringdon Avenue, London, E.C.

FORGING PRESSES—
Berry, Henry, & Co., Ltd., Croydon Works, Leeds.
Fielding & Platt, Ltd., Atlas Works, Gloucester.
Mactaggart, Scott & Co., Ltd., Loanhead, Edinburgh.

FORGINGS—
Brown, John & Co., Ltd., Atlas Works, Sheffield.
Cammell Laird & Co., Ltd., Birkenhead.
Darlington Forge Co., Ltd., Darlington.
Evans, Joseph, & Co., Ltd., Liverpool Street Mills, Birmingham.
Hingley, N., & Sons, Ltd., Netherton Iron Works, Staffs.
Richards, Edwin, & Sons, Ltd., Portway Works, Wednesbury.
Sunderland Forge & Engineering Co., Ltd., Sunderland.
Wall's Ltd., Crown Works, Fazeley Street, Birmingham.

FORGINGS (Bronze)—
Delta Metal Co., Delta Works, East Greenwich, London, S.E.

FORGINGS (Steel)—
Brown, John, & Co., Ltd., Atlas Works, Sheffield.
Darlington Forge Co., Ltd., Darlington.
Spencer John, & Sons, Ltd., Newburn-on-Tyne.
The Midvale Steel Co. of Philadelphia and London, Ltd., 26, Victoria Street, S.W.

FRICTION SURFACES—
Herbert Frood Co., Ltd., The, Chapel-en-le-Frith.

FUEL OIL—
The Anglo-Mexican Petroleum Co., Ltd., Finsbury Court, Finsbury Pavement, E.C.

FUMIGATORS—
Low, Archibald, & Sons, Ltd., 78, Merkland Street, Partick, Glasgow.

FURNACE BRIDGES—
Goulds' Foundries, Ltd., Cardiff.
Hamilton, A., & Sons, 13, Bute Crescent, Docks, Cardiff.

FURNACES—
Brown, John, & Co., Ltd., Atlas Works, Sheffield.
Deighton's Patent Flue & Tube Co., Ltd., Vulcan Works, Pepper Road, Leeds.
Leeds Forge Co., Ltd., Leeds.
Piggott, T., & Co., Ltd., Birmingham.

GALLEY GEAR—
Grieve, T. & Sons, Bedford Street, North Shields.

GALVANIZERS—
Braby, F., & Co., Ltd., Eclipse Works, Glasgow.
Scottish Tube Co., Ltd., 34, Robertson Street, Glasgow.
Wall's Ltd., Crown Works, Fazeley Street, Birmingham.

GAS ENGINES—
British Westinghouse Electric & Mfg. Co., Ltd., Trafford Park, Manchester.
Mather & Platt, Ltd., Manchester.
Norris, Henty & Gardners, Ltd., 87, Queen Victoria Street, London, E.C.

GAUGES—
Chatwin, Thos., Ltd., Gt. Tindal Street, Birmingham.

GEAR CUTTING—
Campbells & Hunter, Ltd., Dolphin Foundry, Leeds.
Wallwork, Henry, & Co., Ltd., Roger Street, Manchester.

GEARING—
British Thomson-Houston Co., Ltd., Rugby.
Brown, David, & Sons, Ltd., Lockwood, Huddersfield

GEARING (*contd.*)—
Campbells & Hunter, Ltd., Dolphin Foundry, Leeds.
Lancaster & Tonge, Ltd., Pendleton, Manchester.
Power Plant Co., Ltd., West Drayton, Mx.
Spencer, John, & Sons, Ltd., Newburn-on-Tyne.
Wallwork, Henry, & Co., Ltd., Roger Street, Manchester.

GLASS—
Triplex Safety Glass Co., Ltd., 1, Albemarle Street, London, W.

GRAIN DISCHARGING PLANT—
Spencer & Co., Ltd., Melksham, Wilts.

GRINDING MACHINES—
Greenwood & Batley, Ltd., Albion Works, Leeds.

GRINDING WHEEL MACHINES—
Sterne, L., & Co., Ltd., Crown Iron Works, Glasgow.

HATCH COVERS (Patent)—
Hogg-Carr Construction Co., Ltd., Newcastle-on-Tyne.

HAWSERS—
Brown, W. B., & Co. (Bankhall), Ltd., Globe Works, Bankhall, Liverpool.
Newall, R. S. & Son, Ltd., Linacre, Liverpool.

HEATING APPARATUS—
Low, Archibald, & Sons, Ltd., 78, Merkland Street, Partick, Glasgow.
Thermotank Co., 55, West Regent Street, Glasgow.

HELM SIGNAL TELEMOTORS—
Mactaggart, Scott & Co., Ltd., Loanhead, Edinburgh.

HIGH SPEED DRILLS—
Brown, John, & Co., Atlas Works, Sheffield.

HIGH SPEED STEEL—
Brown, John, & Co., Atlas Works, Sheffield.

HOISTS—
Mather & Platt, Ltd., Manchester.
Stothert & Pitt, Ltd., Bath.

HOSE—
Heinke, C. E., & Co., 88, 89, Grange Road, Bermondsey, London, S.E.

HYDRAULIC CRANES—
Berry, Henry, & Co., Ltd., Croydon Works, Leeds.
Brown Brothers & Co., Ltd., Rosebank Iron Works, Edinburgh.
Mactaggart, Scott & Co., Ltd., Loanhead, Edinburgh.

HYDRAULIC MACHINERY—
Berry, Henry, & Co., Ltd., Croydon Works, Leeds.
Fielding & Platt, Ltd., Atlas Works, Gloucester.

HYDRANTS—
McRobie, John, & Sons, 94, Elliott Street, Cranstonhill, Glasgow.

INDIARUBBER—
Heinke, C. E., & Co., 88, 89, Grange Road, Bermondsey, London, S.E.

INDUCED DRAUGHT—
Davidson & Co., Ltd., Sirocco Engineering Works, Belfast.
Keith, James, & Blackman Co., Ltd., 27, Farringdon Avenue, London, E.C.

INSULATING MATERIAL—
J. D. Insulating & Refrigerating Co., 3, Cook Street, Liverpool.
Newall's Insulation Co., Ltd., Newcastle-on-Tyne.

INSULATIONS—
J.D. Insulating & Refrigerating Co., 3, Cook Street, Liverpool.
Liverpool Refrigeration Co., Ltd., Colonial House, Liverpool.

IRON ROOFS AND BUILDINGS—
Braby, F., & Co., Ltd., Eclipse Works, Glasgow.

JOINTING MATERIALS—
The Beldam Packing & Rubber Co., Ltd., 29, Gracechurch Street, E.C.
House, Fredk. & Co., 68, Falkner Street, Liverpool.
Ferguson & Timpson, Ltd., 50, Wellington Street, Glasgow.

JOINTING MATERIAL (Manganesite)—
Hudson & Co.'s Successors, John, 15, Victoria Warehouses, Mansell St., E.C.

LAMPS AND LIGHTS—
Grieve, T., & Sons, Bedford Street, North Shields.
Kaye, Joseph, & Sons, Ltd., Leeds.

LATHES—
Herbert, Alfred, Ltd., Coventry.
Scott Bros., Keighley.
Universal Machinery Corporation, Ltd., 326, Old Street, London, E.C.

LAUNCHES—
Crichton, J., & Co., Saltney Shipyard, Chester.
Livingstone & Cooper, Ltd., Hessle, Hull.
Perman & Co., Ltd., 82-83, Fenchurch Street, E.C.
Seamless Steel Boat Co., Ltd., Wakefield.
Thornycroft, John I., & Co., Ltd., Caxton House, Westminster, London, S.W.
Watson, J. S., Gainsborough.
White, J. Samuel, & Co., Ltd., East Cowes, I.W.

LAVATORY FITTINGS AND APPLIANCES—
Levick, John, Ltd., Alma Street, Aston, Birmingham.
Wall's Ltd., Crown Works, Fazeley Street, Birmingham.

LEAD (Sheets and Pipes)—
Rimer Bros., Newcastle-on-Tyne.

LEAD (White and Red)—
Rimer Bros., Newcastle-on-Tyne.

LIFEBOATS—
British Marine Motor & Launch Co., Ltd. Whiteinch, Glasgow.

LIFTS AND HOISTS—
Holt & Willetts, Lion Works, Cradley Heath.
Mactaggart, Scott & Co., Ltd., Loanhead, Edinburgh.

LIGHTERS—
Chalmers, Wm., & Co., Ltd., Rutherglen, nr. Glasgow.
Crichton, J., & Co., Saltney Shipyard, Chester.
Watson, J. S., Gainsborough.

LOCKS—
Kaye, Joseph, & Sons, Ltd., Leeds.

LOCOMOTIVE TUBES (Copper and Brass)—
Yorkshire Copper Works, Ltd., Leeds.

LOCOMOTIVE TUBES (Iron & Steel)—
Bolton, Thos., & Sons, Ltd., 57, Bishopsgate, E.C.
Scottish Tube Co., Ltd., 34, Robertson Street, Glasgow.

LUBRICATORS—
McRobie, John, & Sons, 94, Elliott Street, Cranstonhill, Glasgow.

MACHINE TOOLS—
Bliss, E. W., Co., 1A, Pocock Street, Blackfriars Road, London, S.E.
Campbells & Hunter, Ltd., Dolphin Foundry, Leeds.
Greenwood & Batley, Ltd., Albion Works, Leeds.
Fielding & Platt, Ltd., Atlas Works, Gloucester.
Herbert, Alfred, Ltd., Coventry.
Scott Bros, Keighley
Scriven & Co., Leeds Old Foundry, Leeds.
Universal Machinery Corporation, Ltd., 326, Old Street, London, E.C
Wallwork, Henry, & Co., Ltd., Roger Street, Manchester.

MAGNESIA—
Newall's Insulation Co., Ltd., Newcastle-on-Tyne.

MARINE ENGINE BUILDERS AND REPAIRERS—
Alison, J. Gordon, & Co., Ltd., Dock Engine Works, Birkenhead.
Bailey, C. H., Newport, Mon.
Barry Graving Dock & Engineering Co., Ltd., Barry Docks.
Belliss & Morcom, Ltd., Ledsam Street Works, Birmingham.
British Ljungstrom Marine Turbine Co., Ltd., 22, Billiter Street, London, E.C.
Brown, John, & Co., Ltd., Clydebank, nr. Glasgow.
Central Marine Engine Works, West Hartlepool.
Crichton, C. & H., Ltd., Huskisson Engine Works, Liverpool.
Day, Summers & Co., Ltd., Northam Ironworks, Southampton.
Diamond, Thos., & Co., Cardiff.
Doxford, Wm., & Sons, Ltd., Sunderland.
Elliott & Jeffery, East Dock, Cardiff.
Gleniffer Motors, Ltd., Temple Works, Anniesland, Glasgow.
Gray, Wm., & Co., Ltd., West Hartlepool.
Harland & Wolff, Ltd., Belfast.
Harris Bros., Ltd., Cambrian Dry Docks, Swansea.
Hawthorn, R. & W., Leslie & Co., Ltd., Hebburn-on-Tyne.
Hill's Dry Docks & Engineering Co., Ltd., Cardiff.
Kincaid, J. G., & Co., Ltd., Greenock.
Laing, Sir James & Sons, Ltd., Deptford Yard, Sunderland.
Livingstone & Cooper, Ltd., Hessle, Hull.
Morday, Carney & Co., Ltd., Newport, Mon.
Mountstuart Dry Docks, Ltd., Cardiff.
North Eastern Marine Engineering Co., Ltd., Wallsend-on-Tyne.
Perman & Co., Ltd., 82-83, Fenchurch Street, E.C.
Petters, Ltd., 73, Queen Victoria Street, London, E.C.
Richardsons, Westgarth & Co., Ltd., Hartlepool, Middlesbrough and Sunderland.
Rowan, David, & Co., 231, Elliot Street, Glasgow.
Shearman, John, & Co., Ltd., Cardiff.
Short Bros., Ltd., Pallion Shipyard, Sunderland.
Simons, Wm., & Co., Ltd., Renfrew, nr. Scotland.
Societe Marseillaise de Constructions Mecaniques, Marseilles, France.
Stephen, Alex, & Sons, Ltd., Linthouse, Govan, Glasgow.
Swan, Hunter, & Wigham Richardson, Ltd., Wallsend-on-Tyne.
Thornycroft, John I., & Co., Ltd., Caxton House, Westminster, S.W.
Thompson, Joseph, & Sons, Ltd., Sunderland.
Wallsend Slipway & Engineering Co., Ltd., Wallsend-on-Tyne.

MARINE ENGINE BUILDERS AND REPAIRERS (contd.)—
White, J. Samuel, & Co., Ltd., East Cowes, I.W.
Workman Clark & Co., Ltd., Belfast.
Yarrow & Co., Ltd., Glasgow.

MARKING-OFF TABLES—
Campbells & Hunter, Ltd., Dolphin Foundry, Leeds.

MATTRESSES—
Atlas Co., Ltd., Atlas Works, Bilston.
Stewart, Archibald, & Co., 40-48, Union Street, Glasgow.
Whitfields Bedsteads, Ltd., 109-125, Watery Lane, Bordesley Birmingham

MECHANICAL LEATHERS—
Walco Ltd., 60, Slaney Street, Birmingham.

MECHANICAL STOKERS—
Alison, J. Gordon, & Co., Ltd., Dock Engine Works, Birkenhead.

METALLIC PACKING—
Aston Chain & Hook Co., Ltd., Erdington, Birmingham.
Beldam Packing & Rubber Co., Ltd., 1 and 2, Gracechurch Street, London, E.C.
Lancaster & Tonge, Ltd., Pendleton, Manchester.
United States Metallic Packing Co., Ltd., Bradford.

METAL SPINNINGS—
Levick, John, Ltd., Alma Street, Aston, Birmingham.

METALS (Patent)—
Bowran, Robt., & Co., Ltd., Newcastle-on-Tyne
Delta Metal Co., Ltd., Delta Works, East Greenwich.

MEXICAN FUEL OIL—
Anglo-Mexican Petroleum Co., Ltd., Finsbury Court, Finsbury Pavement, E.C.

MILLING MACHINES—
Herbert, Alfred, Ltd., Coventry.

MOTOR BOATS—
Crichton, J., & Co., Saltney Shipyard, Chester.
Gleniffer Motors, Ltd., Temple Works, Anniesland, Glasgow.
Livingstone & Cooper, Ltd., Hessle, Hull.
Perman & Co., Ltd., 82-83, Fenchurch Street, E.C.
Seamless Steel Boat Co., Ltd., Wakefield.
Thornycroft, John I., & Co., Ltd., Caxton House, Westminster, London, S.W.
White, J. Samuel, & Co., Ltd., East Cowes, I.W.

MOTOR STARTING AND CONTROL GEAR—
British Thomson-Houston Co., Ltd., Rugby.
Holmes, J. H., & Co., Portland Road, Newcastle-on-Tyne.

MOULDING MACHINES—
Britannia Foundry Co., Coventry.

NAVAL ARCHITECTS' SUPPLIES—
Walker, Jas., & Co., 11, Bishop Court, Anderston, Glasgow.

OIL CANS—
Kaye, Joseph, & Sons, Ltd., Leeds.
Valor Co., Ltd., Rocky Lane, Aston Cross, Birmingham.

OIL ECONOMISERS—
Kaye, Joseph, & Sons, Ltd., Leeds.

OIL ENGINES—
Belliss & Morcom, Ltd., Ledsam Street Works, Birmingham.
British Westinghouse Electric & Mfg. Co., Ltd., Trafford Park, Manchester.
Fyfe Wilson & Co., 155a, St. Vincent Street, Glasgow.
Gleniffer Motors, Ltd., Temple Works, Anniesland, Glasgow.
Norris, Henty & Gardners, Ltd., 87, Queen Victoria Street, London, E.C.
North Eastern Marine Engineering Co., Ltd., Wallsend-on-Tyne and Sunderland.
Perman & Co., Ltd., 82-83, Fenchurch Street, E.C.
Petters, Ltd., 73, Queen Victoria Street, London, E.C.
Swan, Hunter & Wigham Richardson, Ltd., Wallsend-on-Tyne.
Thornycroft, John I., & Co., Ltd., Caxton House, Westminster, S.W.
Wallsend Slipway and Engineering Co., Ltd., Wallsend-on-Tyne.
White, J. Samuel, & Co., Ltd., East Cowes, I.W.

OIL FILTERS—
Valor Co., Ltd., Rocky Lane, Aston Cross, Birmingham.

OIL & GREASE LUBRICANTS—
Rimer Bros., Milburn House, Newcastle-on-Tyne.

OIL FUEL—
Anglo-Mexican Petroleum Co., Ltd., Finsbury Court, Finsbury Pavement, E.C.

OIL-FUEL INSTALLATION—
Wallsend Slipway & Engineering Co., Ltd., Wallsend-on-Tyne.
White, J. Samuel, & Co., Ltd., East Cowes, I.W.

OIL IMPORTERS & BLENDERS—
Rimer Bros., Newcastle-on-Tyne.

OIL STORAGE CABINETS—
Valor Co., Ltd., Rocky Lane, Aston Cross, Birmingham.

PACKING (Engine)—
Beldam Packing & Rubber Co., Ltd., 29, Gracechurch Street, London, E.C.
Ferguson & Timpson, Ltd., 50, Wellington Street, Glasgow.
Walker, Jas., & Co., Ltd., Lion Works, Garford Street, West India Dock Road, E.

PAINTS—
Briggs, W., & Sons, Ltd., Dundee.
Hamilton, Archd. H., & Co., Possilpark, Glasgow.
Websters, Ltd., Hull.

PANELLING—
Stewart, Archibald, & Co., 40-48, Union Street, Glasgow.

PATENT HAWSE PIPE AND DECK FLANGE—
Hamilton, A., & Sons, 13, Bute Crescent, Docks, Cardiff.

PERFORATED METALS—
Braby, F., & Co., Ltd., Eclipse Works, Glasgow.
Piggott, T., & Co., Ltd., Birmingham.

PIPES—
Bolton, Thos., & Sons, Ltd., 57, Bishopsgate, E.C.
Scottish Tube Co., Ltd., 34, Robertson Street, Glasgow.
Stewarts & Lloyds, Ltd., 41, Oswald Street, Glasgow.
Yorkshire Copper Works, Ltd., Leeds.

PISTONS—
Lancaster & Tonge, Ltd., Pendleton, Manchester.

PLANING MACHINES for Plate Edges—
Bliss, E. W., Co., 1a, Pocock Street, Blackfriars Road, London, S.E.
Scriven & Co., Leeds Old Foundry, Leeds.

PLATE BENDING ROLLS—
Bliss, E. W., Co., Pocock Street, Blackfriars Road, S.E.
Scriven & Co., Leeds Old Foundry, Leeds.

PORCELAIN ENAMELLED CAST IRON—
Levick, John, Ltd., Alma Street, Aston, Birmingham, Liverpool.

PROPELLERS—
Bull's Metal & Melloid Co., Ltd., Yoker, nr. Glasgow.
Crichton, C. & H., Ltd., Huskisson Engine Works.
Darlington Forge Co., Ltd., Darlington.
Goulds' Foundries, Ltd., Cardiff.
Spencer, John, & Sons, Ltd., Newburn-on-Tyne.

PROPELLER BLADES—
Darlington Forge Co., Ltd., Darlington.
Stewarts & Lloyds, Ltd., 41, Oswald Street, Glasgow.

PULLEY BLOCKS—
Fellows Bros., Clyde Works, Cradley Heath.
Higginson & Co., 7, Hurst Street, Liverpool.
Holt & Willetts, Lion Works, Cradley Heath.
Loveridge, Ltd., Cardiff.
Wright, Joseph, & Co., Ltd., Tipton, Staffs.

PUMPS—
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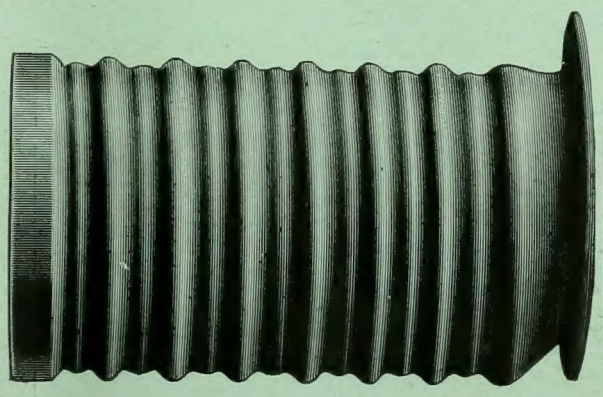

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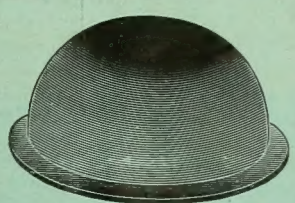

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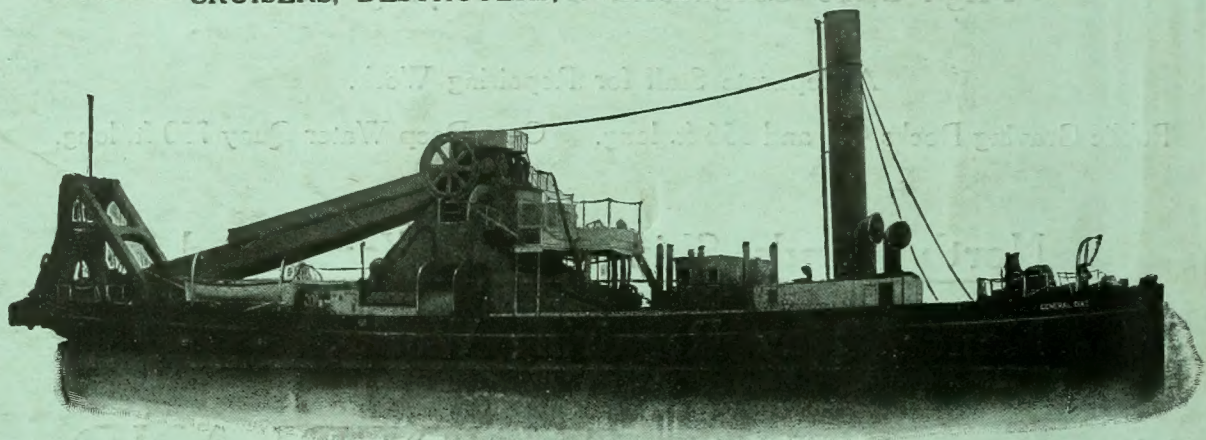

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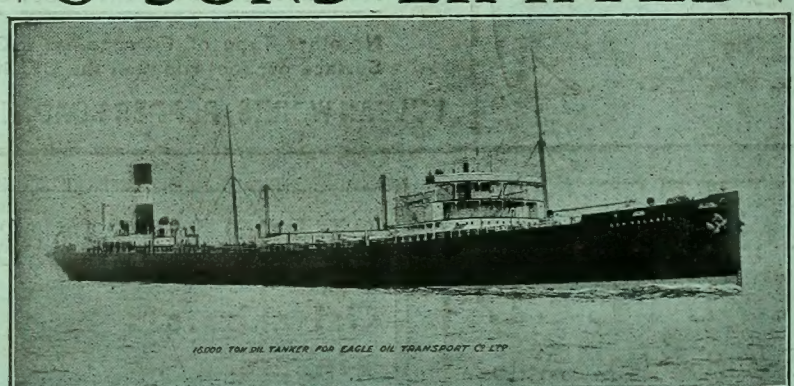

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